

GREGG I. ANDERSON (SBN:255556)
 MAHA SARAH (SBN:218981)
 GORDON & REES LLP
 101 West Broadway, Suite 2000
 San Diego, CA 92101
 Telephone:(619) 696-6700
 Facsimile:(619) 696-7124
 Email: ganderson@gordonrees.com
msarah@gordonrees.com

Attorneys for Plaintiff,
 FaceDouble, Inc.

FILED

10 MAR -5 PM 1:35

CLERK, U.S. DISTRICT COURT
 SOUTHERN DISTRICT OF CALIFORNIA

[Signature]
 DEPUTY

UNITED STATES DISTRICT COURT
 SOUTHERN DISTRICT OF CALIFORNIA

FACEDOUBLE, INC., a California
 corporation,

Plaintiff,

vs.

THE COCA-COLA COMPANY, a Delaware
 corporation and CRISPIN PORTER &
 BOGUSKY, LLC, a Delaware limited liability
 corporation,

Defendants.

Case No. 10 CV 0485 IEG RBB

COMPLAINT FOR PATENT
 INFRINGEMENT AND DEMAND FOR
 JURY TRIAL (INJUNCTIVE RELIEF
 REQUESTED)

Plaintiff, FaceDouble, Inc., a California corporation, for its complaint against Defendants
 The Coca-Cola Company and Crispin Porter & Bogusky, LLC, hereby alleges as follows:

JURISDICTION AND VENUE

1. This Complaint states causes of action for patent infringement arising under the
 patent laws of the United States, 35 U.S.C. § 100 *et seq.*, and, more particularly 35 U.S.C. § 271.

2. This Court has subject matter jurisdiction of this action under 28 U.S.C. §§ 1331
 and 1338(a) in which the district courts have original and exclusive jurisdiction of any civil
 action for patent infringement and 28 U.S.C. § 1367 in which the district courts have
 supplemental jurisdiction over all other claims that are so related to the claims for which the
 district court has original jurisdiction.

3. Venue is proper in this Court under 28 U.S.C. §§ 1391(b) and (c) and 1400(b).

GORDON & REES, LLP
 101 West Broadway, Suite 2000
 San Diego, CA 92101
 (619) 696-6700

ORIGINAL

THE PARTIES

4. Plaintiff FaceDouble, Inc. ("FaceDouble") is incorporated under the laws of the State of California, and has a regular and established place of business in San Diego, California.

5. Upon information and belief, defendant The Coca-Cola Company ("Coca-Cola") is a Delaware corporation licensed to conduct and transacting business in the State of California.

6. Upon information and belief, defendant Crispin Porter & Bogusky, LLC ("Crispin Porter") is a Delaware limited liability corporation licensed to conduct and transacting business in the State of California.

BACKGROUND FACTS

7. Beginning in late 2004 the founders of FaceDouble, began development of software face matching applications in the social networking context that would identify, compare, contrast, search, tag and identify photographic images of individuals using wireless devices, wireless networks and the internet.

8. The software applications include FACEDOUBLE® and FaceDouble Twins™ ("FACEDOUBLE Applications"), were developed into a commercial program over the next six years. FaceDouble has invested substantial capital to commercialize the FACEDOUBLE Applications.

9. The FACEDOUBLE Applications, among other features, allow a user to identify another person who looks like the user. The look alikes are identified from a database which may be accessed from a wireless device, cell phone or other network connected device over the internet.

10. The user can engage in several activities facilitated by the application, including the ability to cast votes for the best matches in an online user community, including a wireless device, cell phone or other network connected device. Various combinations of people may be rated using a variety of techniques, including human perception. The photos with the most points based on the voting from the website are listed separately on the website for all users to view.

1 11. Beginning in 2005, the FACEDOUBLE Applications were placed on popular
2 social networking websites, including Facebook and MySpace and were approved by numerous
3 wireless carriers.

4 12. The FACEDOUBLE Applications have achieved substantial commercial success
5 and acclaim as a social networking application having twenty five million (25) million users.

6 13. On information and belief, Crispin Porter is an advertising agency which was
7 hired by Coca-Cola in the fall of 2009 to develop an advertising campaign to market a Coca-Cola
8 soft drink product Coke Zero.

9 14. Coke Zero is a variation of the Coca-Cola soft drink historically sold by Coca-
10 Cola. Coke Zero is marketed as having zero sugar and calories.

11 15. Since the inception of the Coke Zero product, marketing has also emphasized its
12 similarity in taste to the sugared Coca-Cola product through a 2007 viral marketing campaign
13 that suggested the company's executives were so angry over the drinks' similarities they were
14 considering suing their coworkers for "taste infringement". Viral marketing uses pre-existing
15 social networks to produce increases in brand awareness or to achieve other marketing
16 objectives, including product sales, analogous to the spread of pathological and computer
17 viruses.

18 16. In furtherance of their viral marketing campaign, Coca-Cola implemented an
19 internet software application known as Coke Zero Facial Profiler. The Coke Zero Facial Profiler
20 matches facial images of a user with other users on either the Facebook website or at Coca-
21 Cola's own website, www.cocacolazero.com. As directed by the Coke Zero Facial Profiler
22 application, users submit their facial images, *e.g.* picture, to Coca-Cola.

23 17. On information and belief, Crispin Porter developed the Coke Zero Facial Profiler
24 application for Coca-Cola and the website where the application is run.

25 18. At all relevant times, Coca-Cola has operated the Coke Zero Facial Profiler which
26 allows users to access the application and identify other users with similar facial appearance.
27 Access may be by a wireless device, cell phone or other internet connected device.
28

GORDON & REES, LLP
101 West Broadway, Suite 2000
San Diego, CA 92101
(619) 696-6700

19. On November 13, 2009, FaceDouble wrote Joseph V. Ripodi, Russell Baker and Pio Schunker of Coca-Cola to make Coca-Cola aware of four United States patents related to face matching applications in the social networking context. The letter was followed up by phone calls to the same individuals.

20. FaceDouble is the owner by assignment from the named inventors of a certain patent relating to Digital Image Search System and Method filed in the United States Patent Office ("PTO") and upon which a patent issued as U.S. Patent No. 7,599,527 on October 6, 2009 ("the '527 patent"), a true and correct copy of which is attached hereto as Exhibit A.

21. FaceDouble is the owner by assignment from the named inventors of a certain patent relating to Image Classification and Information Retrieval Over Wireless Digital Networks and the Internet filed in the PTO and upon which a patent issued as U.S. Patent No. 7,668,348 on February 23, 2010 ("the '348 patent"), a true and correct copy of which is attached hereto as Exhibit B.

COUNT I – INFRINGEMENT OF U.S. PAT. NO. 7,599,527

For Count I of its Complaint against Defendants Coca-Cola and Crispin Porter, FaceDouble alleges as follows:

22. Each allegation contained in paragraphs 1 –22 above is incorporated by reference as though set forth fully herein.

23. Upon information and belief, Coca-Cola and Crispin Porter each have infringed, induced, contributed to, aided and abetted in or directed or controlled the infringement of one or more claims of the '527 patent within the United States without authority of FaceDouble by making or using or contributing to, inducing or directing and controlling others use of the Coke Zero Facial Profiler on the website www.cocacolazero.com under the terms and provisions of 35 U.S.C. §271 (a), (b) and/or (c).

24. Coca-Cola and Crispin Porter had actual knowledge that the Coke Zero Facial Profiler software application on the website www.cocacolazero.com was patented and that the '527 patent was owned by FaceDouble.

1 25. Despite having actual notice of the '527 patent, Coca-Cola and Crispin Porter
2 continue to make, use or contribute to, induce, or direct and control others to make and use the
3 Coke Zero Facial Profiler, knowingly and willfully infringing the '527 patent.

4 26. Coca-Cola and Crispin Porter will derive and receive from the aforesaid
5 infringement gains, profits and advantages, but in what amount FaceDouble is not presently
6 informed and cannot set forth, FaceDouble, by reason of the aforesaid infringement, will be
7 damaged and will be entitled to damages adequate to compensate for the willful infringement by
8 Coca-Cola and Crispin Porter, but in no event less than a reasonable royalty for Coca-Cola and
9 Crispin Porter's use made of the '527 patent as provided under the terms and provisions of 35
10 U.S.C. §284.

11 27. Coca-Cola and Crispin Porter will continue to infringe or induce, contribute,
12 and/or direct and control others to infringe the '527 patent unless enjoined by this Court.

13 28. Coca-Cola and Crispin Porter have willfully and deliberately infringed, induced
14 others to infringe, and/or contributed to the infringement of the '527 patent with full knowledge
15 and wanton disregard of FaceDouble's rights thereunder, rendering this an "exceptional" case
16 within the meaning of 35 U.S.C. § 285.

17 **COUNT II- INFRINGEMENT OF U.S. PAT. NO. 7,668,348**

18 For Count II of its Complaint against Defendants Coca-Cola and Crispin Porter,
19 FaceDouble alleges as follows:

20 29. Each allegation contained in paragraphs 1 –28 above is incorporated by reference
21 as though set forth fully herein.

22 30. Upon information and belief, Coca-Cola and Crispin Porter have infringed,
23 induced, contributed to or aided and abetted in the infringement of one or more claims of the
24 '348 patent within the United States without authority of FaceDouble by making or using or
25 contributing to or inducing others use of the Coke Zero Facial Profiler on the website
26 www.cocacolazero.com, under the terms and provisions of 35 U.S.C. §271 (a), (b) and/or (c).

1 31. Upon information and belief, Coca-Cola and Crispin Porter had actual knowledge
2 that the Coke Zero Facial Profiler software application on the website www.cocacolazero.com
3 was patented and that the '348 patent was owned by FaceDouble.

4 32. Upon information and belief, despite having actual notice of the '348 patent,
5 Coca-Cola and Crispin Porter continue to make, use or contribute to, or induce others to make
6 and use the Coke Zero Facial Profiler on the website www.cocacolazero.com, knowingly and
7 willfully infringing the '348 patent.

8 33. Coca-Cola and Crispin Porter will derive and receive from the aforesaid
9 infringement gains, profits and advantages, but in what amount FaceDouble is not presently
10 informed and cannot set forth, FaceDouble, by reason of the aforesaid infringement, will be
11 damaged and will be entitled to damages adequate to compensate for the willful infringement by
12 Coca-Cola and Crispin Porter, but in no event less than a reasonable royalty for Coca-Cola and
13 Crispin Porter's use made of the '348 patent as provided under the terms and provisions of 35
14 U.S.C. §284.

15 34. Coca-Cola and Crispin Porter will continue to infringe, induce others to infringe,
16 and/or contribute to the infringement of the '348 patent unless enjoined by this Court.

17 35. Coca-Cola and Crispin Porter have willfully and deliberately infringed, induced
18 others to infringe, and/or contributed to the infringement of the '348 patent with full knowledge
19 and wanton disregard of FaceDouble's rights thereunder, rendering this an "exceptional" case
20 within the meaning of 35 U.S.C. § 285.

21 **COUNT III – INJUNCTIVE RELIEF**

22 For Count III of its Complaint against Defendants Coca-Cola and Crispin Porter,
23 FaceDouble alleges as follows:

24 36. Each allegation contained in paragraphs 1 –35 above is incorporated by reference
25 as though set forth fully herein.

26 37. The actions of Defendants Coca-Cola and Crispin Porter leave FaceDouble
27 without an adequate remedy at law for the infringement of the '527 and '348 patents.
28

1 38. FaceDouble is entitled to preliminary and permanent injunctive relief under the
2 terms and provisions of 35 U.S.C. § 283.

3 **PRAYER FOR RELIEF**

4 WHEREFORE, Plaintiff, FaceDouble, Inc. requests the following relief:

5 A. That this Court adjudge and declare that the '527 and '348 patents are good and
6 valid and owned by FaceDouble, Inc. and infringed by Defendants The Coca-Cola Company and
7 Crispin Porter & Bogusky, LLC and;

8 B. That this Court preliminarily and permanently enjoin Defendants The Coca-Cola
9 Company and Crispin Porter & Bogusky, LLC and their officers, directors, employees, agents,
10 licensees, servants, successors and assigns, and any and all persons acting in privity or in concert
11 with them from infringing or actively inducing, contributing or directing or controlling others to
12 infringe the '527 and the '348 patents;

13 C. That this Court award to FaceDouble, Inc. damages adequate to compensate it for
14 Defendants The Coca-Cola Company and Crispin Porter & Bogusky, LLC acts of infringement,
15 inducement of infringement, contributing to the infringement or directing and controlling the
16 infringement by or through others of the '527 and '348 patents complained of herein, together
17 with interest thereon, but in no event less than a reasonable royalty for the use made of the '527
18 and '348 patents;

19 D. That this Court decree that the infringement of the '527 and '348 patents by
20 Defendants The Coca-Cola Company and Crispin Porter & Bogusky, LLC is willful, that this
21 Court award treble damages against Defendants for their willful infringement of the '527 and
22 '348 patents;

23 E. That this Court order Defendants The Coca-Cola Company and Crispin Porter &
24 Bogusky, LLC to pay FaceDouble, Inc.'s reasonable attorneys' fees for this action;

25 F. That this Court order Defendants The Coca-Cola Company and Crispin Porter &
26 Bogusky, LLC pay FaceDouble, Inc. any and all properly chargeable costs for this action;

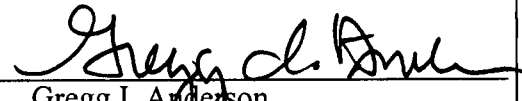
27 G. That prejudgment interest be awarded by the Court from the date suit was filed for
28 any amounts of actual damages; and

1 H. That this Court grant FaceDouble such other and further relief as it may deem just
2 and equitable.

3 Respectfully Submitted,

4 Dated: March 5, 2010

GORDON & REES, LLP

5
6 By: 
7 Gregg I. Anderson
8 Maha Sarah
9 Attorneys for Plaintiff
10 FaceDouble, Inc.

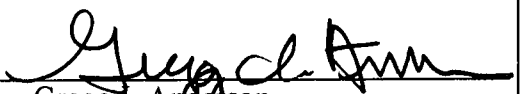
11 **PLAINTIFF'S JURY DEMAND**

12 Pursuant to Rule 28(b) of the Federal Rules of Civil Procedure, Plaintiff FaceDouble, Inc.
13 hereby demands a jury trial of all issues triable to a jury.

14
15 Respectfully Submitted,

16 Dated: March 5, 2010

GORDON & REES, LLP

17
18 By: 
19 Gregg I. Anderson
20 Maha Sarah
21 Attorneys for Plaintiff
22 FaceDouble, Inc.

GORDON & REES, LLP
101 West Broadway, Suite 2000
San Diego, CA 92101
(619) 696-6700

EXHIBIT A

FACEDOUBLE, INC. – COMPLAINT FOR PATENT INFRINGEMENT



US007599527B2

(12) **United States Patent**
Shah et al.

(10) **Patent No.:** **US 7,599,527 B2**
 (45) **Date of Patent:** ***Oct. 6, 2009**

(54) **DIGITAL IMAGE SEARCH SYSTEM AND METHOD**

(75) Inventors: **Alex Shah**, San Diego, CA (US);
Charles A. Myers, La Jolla, CA (US)

(73) Assignee: **Facedouble, Inc.**, San Diego, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/198,887**

(22) Filed: **Aug. 27, 2008**

(65) **Prior Publication Data**

US 2008/0317298 A1 Dec. 25, 2008

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/534,667, filed on Sep. 24, 2006, now Pat. No. 7,450,740.

(60) Provisional application No. 60/721,226, filed on Sep. 28, 2005, provisional application No. 60/968,326, filed on Aug. 28, 2007.

(51) **Int. Cl.**
G06K 9/00 (2006.01)
H04M 1/66 (2006.01)
G06F 7/00 (2006.01)

(52) **U.S. Cl.** **382/118; 455/410; 707/104.1**

(58) **Field of Classification Search** **382/115-118, 382/181, 218, 260, 305, 312; 707/104.1; 455/410**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,805,238 A 4/1974 Rothjell
 4,020,463 A 4/1977 Himmel

4,712,103 A	12/1987	Gotanda	
4,858,000 A	8/1989	Lu	
4,975,969 A	12/1990	Tal	
5,031,228 A	7/1991	Lu	
5,063,603 A	11/1991	Burt	
5,164,992 A	11/1992	Turk et al.	
5,386,103 A	1/1995	DeBan et al.	
5,432,864 A	7/1995	Lu et al.	
5,450,504 A *	9/1995	Calia	382/118
5,991,429 A *	11/1999	Coffin et al.	382/118
6,072,894 A *	6/2000	Payne	382/118
6,430,306 B2	8/2002	Solcum et al.	
6,675,145 B1	1/2004	Yehia et al.	
6,698,653 B1 *	3/2004	Diamond et al.	235/375

(Continued)

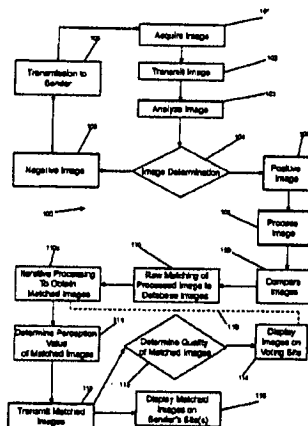
Primary Examiner—Kanji Patel

(74) *Attorney, Agent, or Firm*—Clause Eight IPS; Michael Catania

(57) **ABSTRACT**

A method and system for matching an unknown facial image of an individual with an image of an unknown twin using facial recognition techniques and human perception is disclosed herein. The invention provides a internet hosted system to find, compare, contrast and identify similar characteristics among two or more individuals using a digital camera, cellular telephone camera, wireless device for the purpose of returning information regarding similar faces to the user. The system features classification of unknown facial images from a variety of internet accessible sources, including mobile phones, wireless camera-enabled devices, images obtained from digital cameras or scanners that are uploaded from PCs, third-party applications and databases. The method and system uses human perception techniques to weight the feature vectors.

20 Claims, 7 Drawing Sheets



US 7,599,527 B2

Page 2

U.S. PATENT DOCUMENTS

6,765,470 B2	7/2004	Shinzaki	2002/0118195 A1	8/2002	Pactzold et al.	
6,882,741 B2	4/2005	Dobashi et al.	2003/0034978 A1	2/2003	Buddemeier et al.	
6,919,892 B1	7/2005	Cheiky et al.	2004/0151349 A1	8/2004	Milne et al.	
6,961,466 B2	11/2005	Imagawa et al.	2005/0043897 A1	2/2005	Meyer	
6,970,580 B2	11/2005	Kies	2005/0058320 A1	3/2005	Rhoads et al.	
6,976,629 B2	12/2005	Carlson	2005/0076004 A1	4/2005	Yanagisawa et al.	
7,039,221 B1	5/2006	Tumey et al.	2005/0097131 A1	5/2005	Benco et al.	
7,050,635 B2	5/2006	Javidi et al.	2005/0139782 A1 *	6/2005	Nagahashi et al.	250/459.1
7,095,879 B2	8/2006	Yan et al.	2005/0162523 A1	7/2005	Darrell et al.	
7,123,754 B2	10/2006	Matsuo et al.	2005/0182729 A1	8/2005	Kananen	
7,123,783 B2	10/2006	Gargesha et al.	2005/0185060 A1	8/2005	Neven, Sr.	
7,124,066 B2	10/2006	Marschner et al.	2005/0275506 A1	12/2005	Otsuka	
7,127,086 B2	10/2006	Yuasa et al.	2006/0012677 A1	1/2006	Neven, Sr. et al.	
7,127,087 B2	10/2006	Huang et al.	2006/0029276 A1 *	2/2006	Nagahashi et al.	382/173
7,130,454 B1	10/2006	Berube et al.	2006/0050933 A1	3/2006	Adam et al.	
7,221,931 B2	5/2007	Benco et al.	2008/0212849 A1 *	9/2008	Gao	382/118

* cited by examiner

U.S. Patent

Oct. 6, 2009

Sheet 1 of 7

US 7,599,527 B2

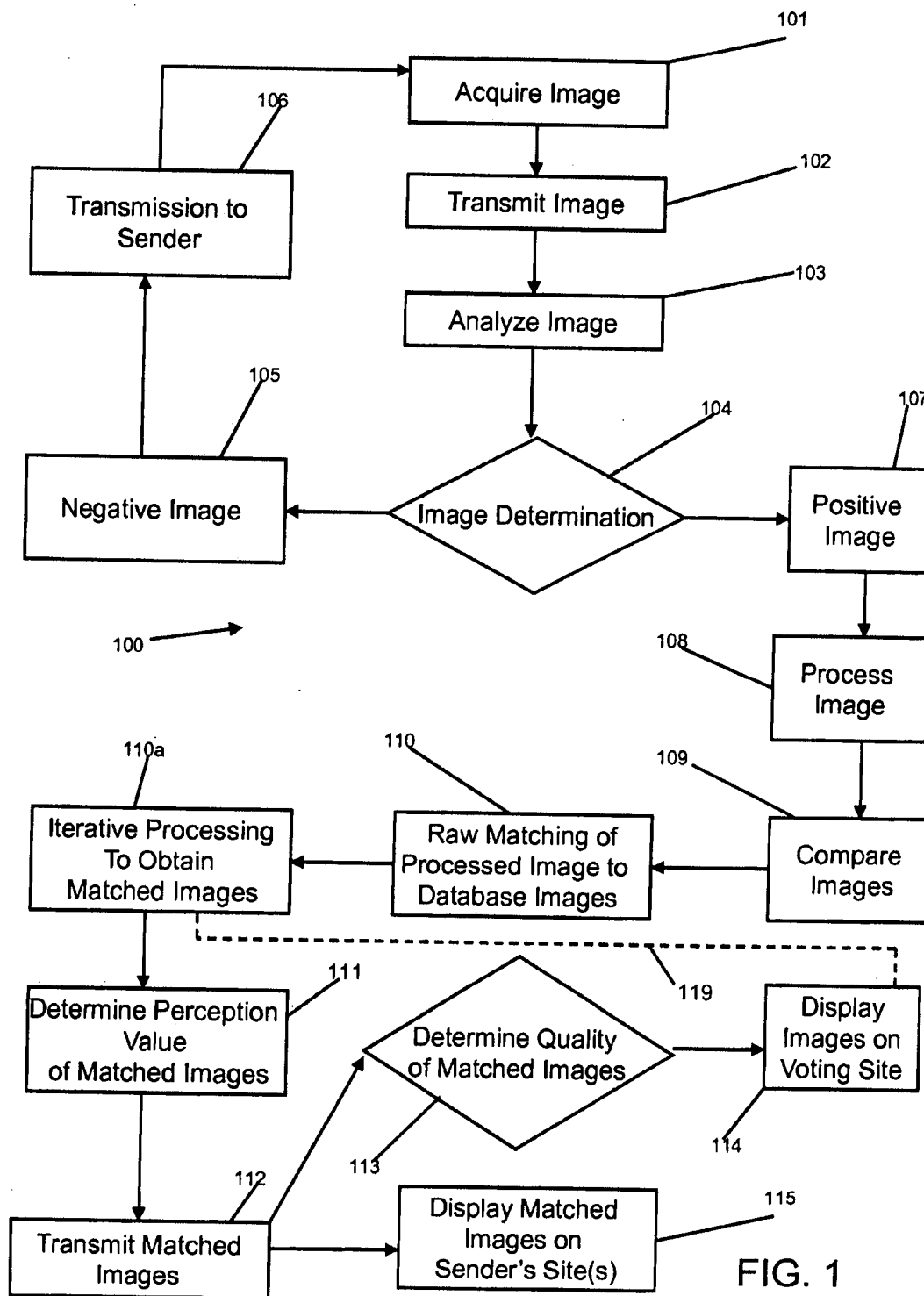


FIG. 1

U.S. Patent

Oct. 6, 2009

Sheet 2 of 7

US 7,599,527 B2

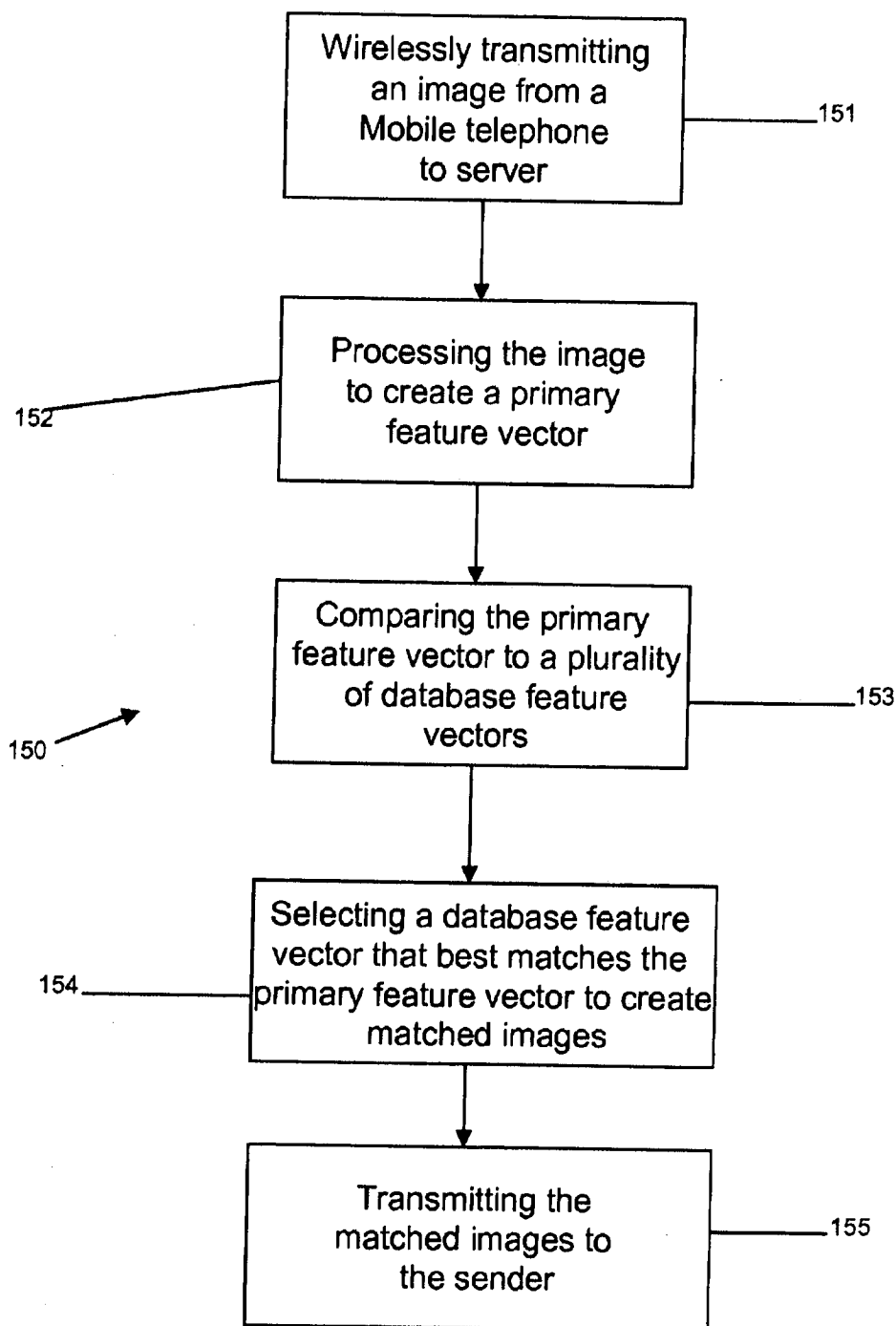


FIG. 2

U.S. Patent

Oct. 6, 2009

Sheet 3 of 7

US 7,599,527 B2

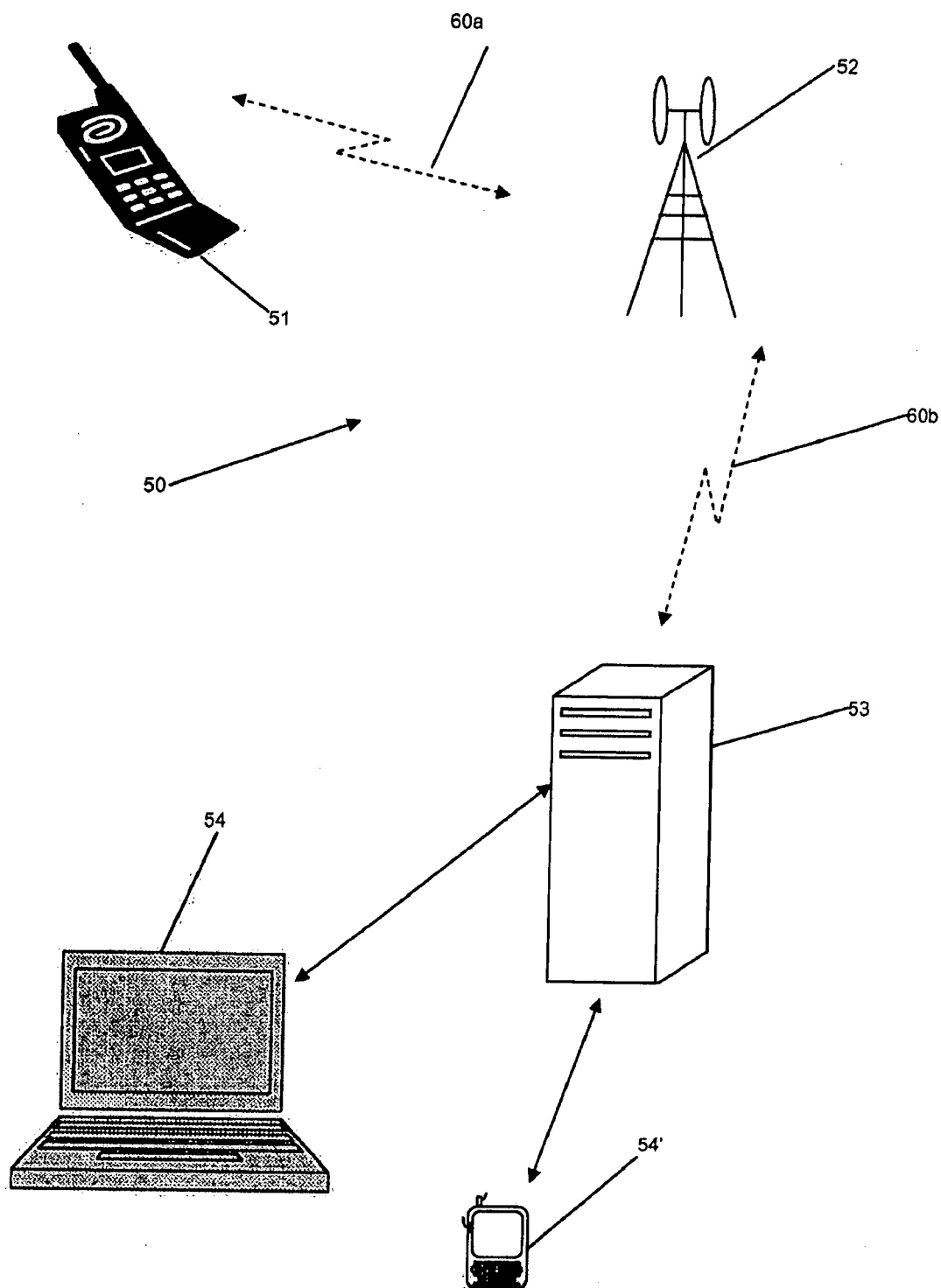


FIG. 3

U.S. Patent

Oct. 6, 2009

Sheet 4 of 7

US 7,599,527 B2

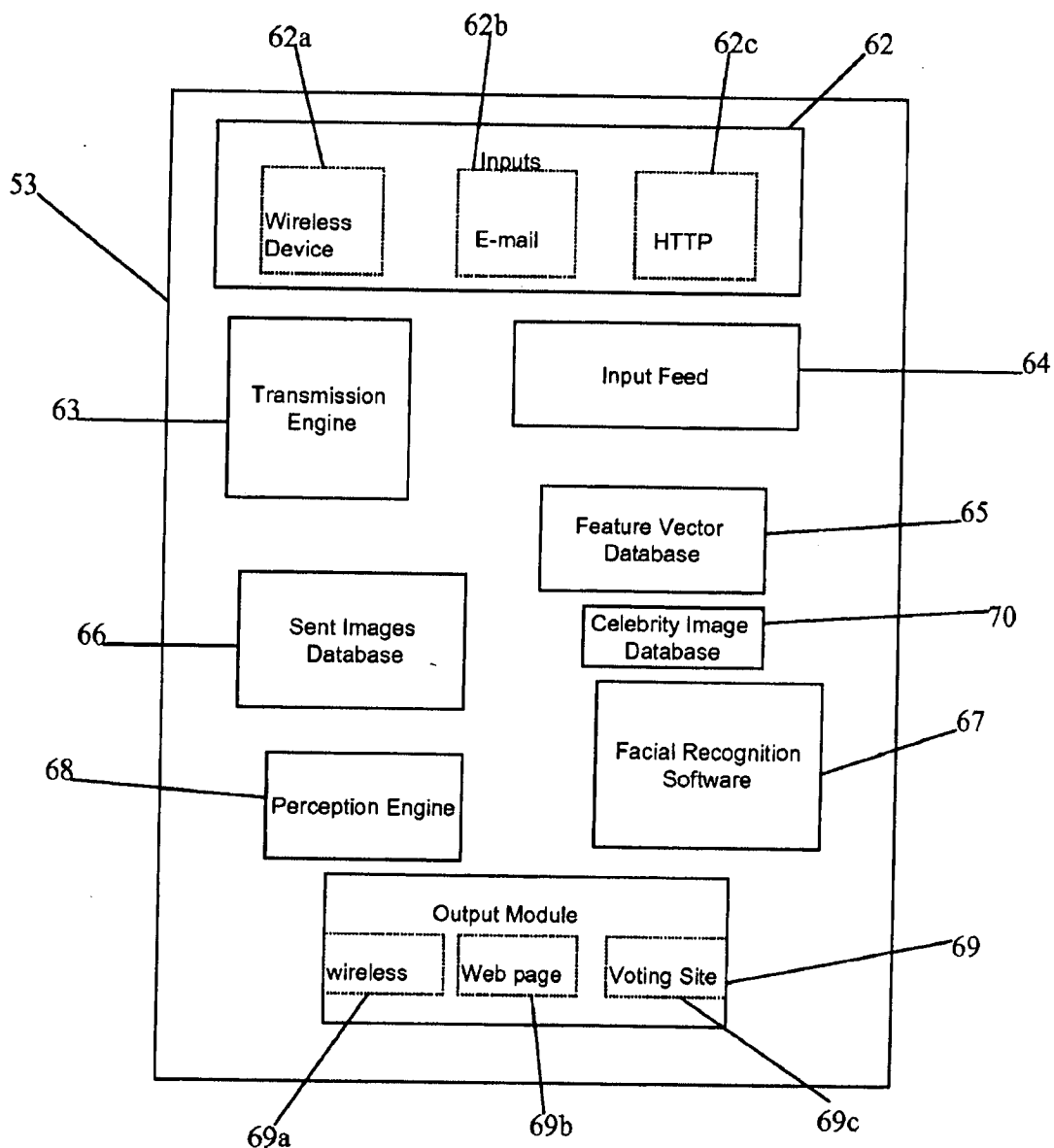


FIG. 3A

U.S. Patent

Oct. 6, 2009

Sheet 5 of 7

US 7,599,527 B2

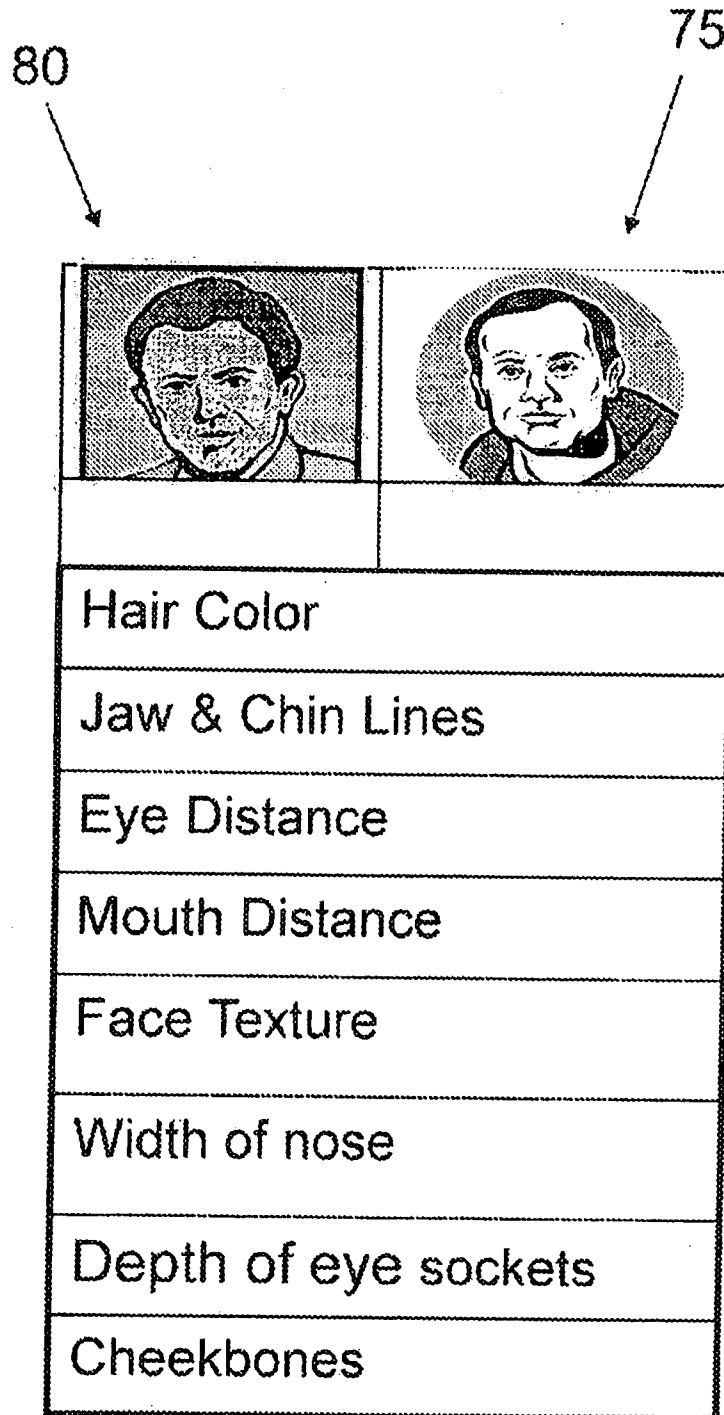


FIG. 4

U.S. Patent

Oct. 6, 2009

Sheet 6 of 7

US 7,599,527 B2

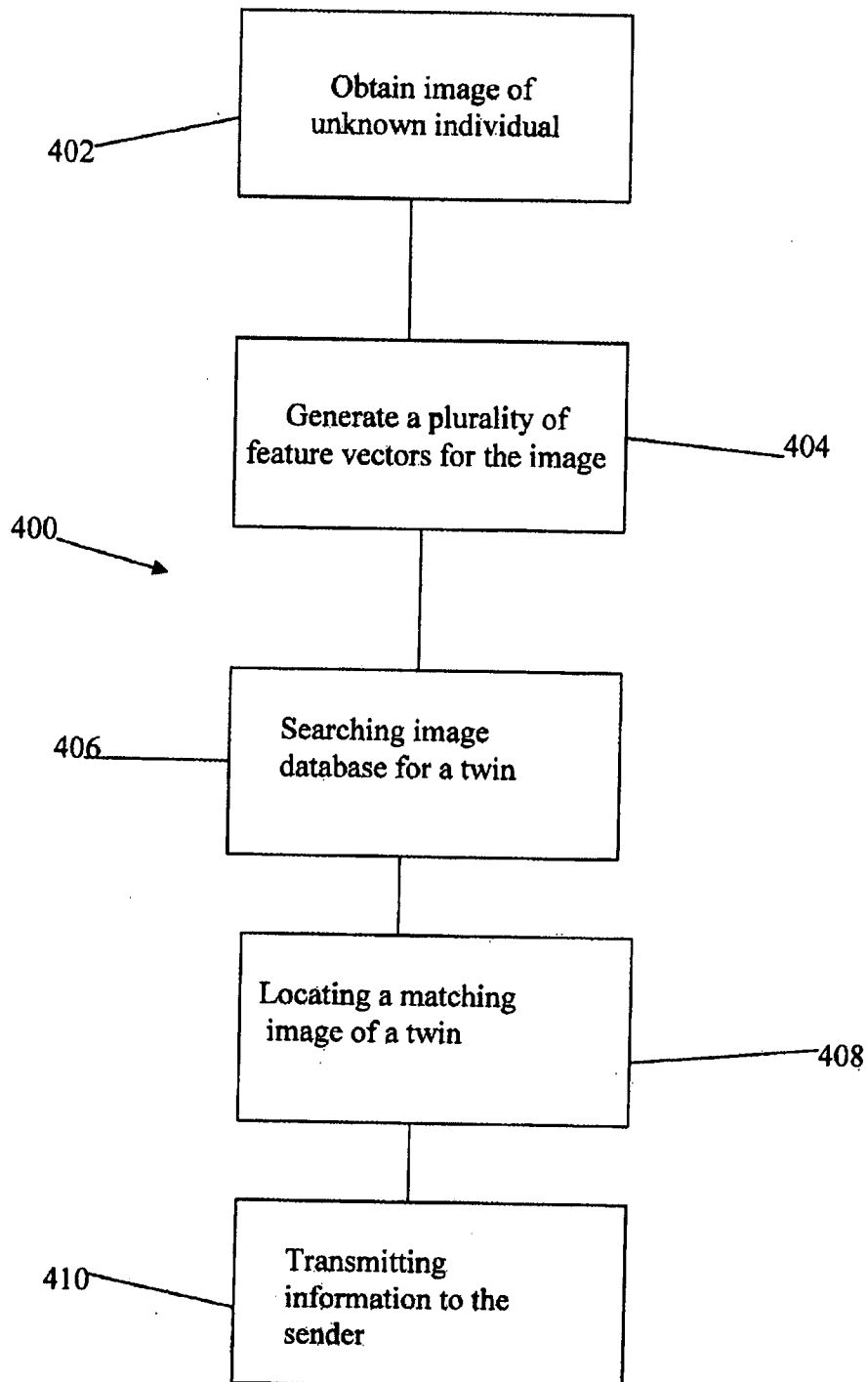


FIG. 5

U.S. Patent

Oct. 6, 2009

Sheet 7 of 7

US 7,599,527 B2

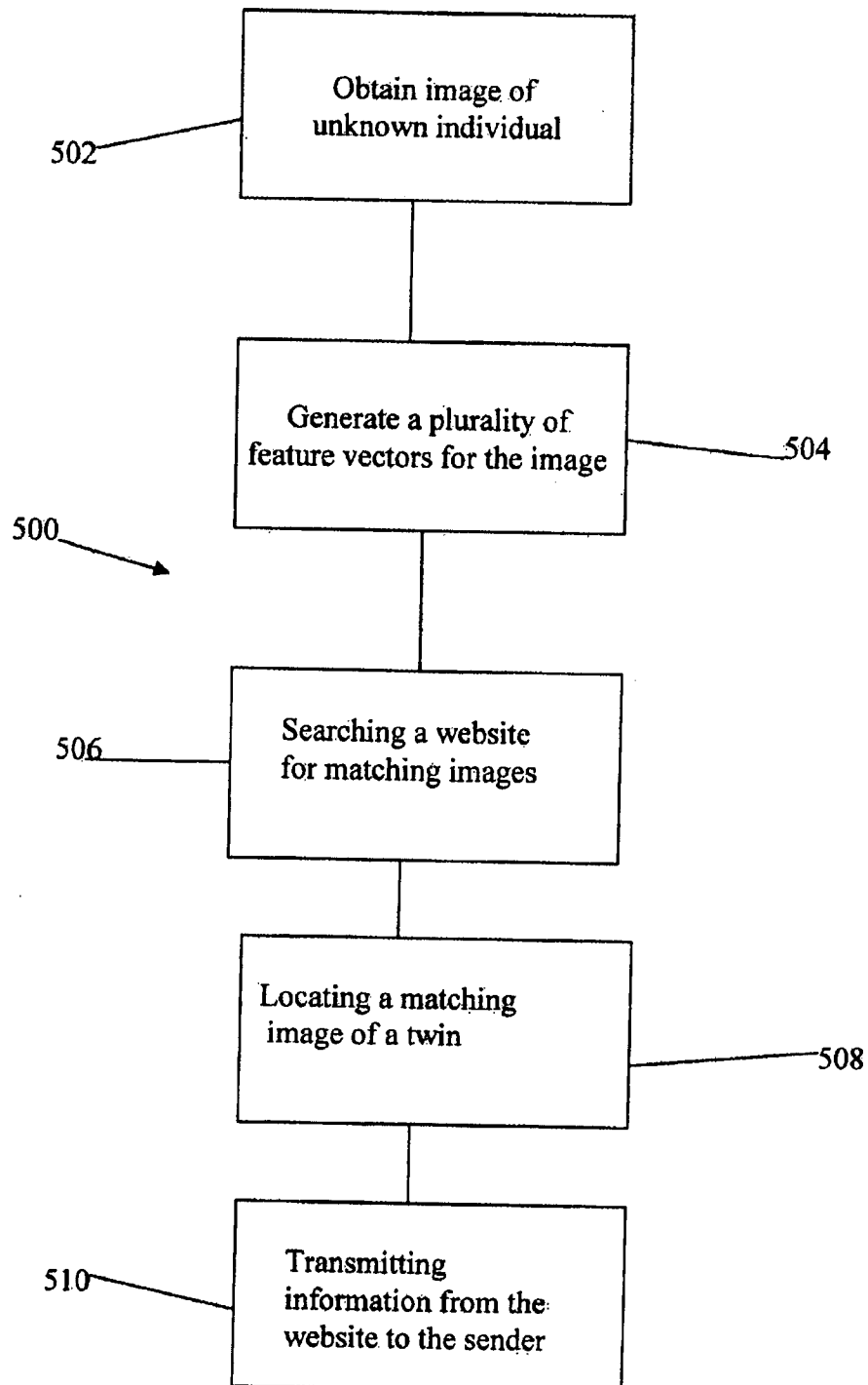


FIG. 6

US 7,599,527 B2

1

DIGITAL IMAGE SEARCH SYSTEM AND METHOD**CROSS REFERENCE TO RELATED APPLICATION**

The Present Application claims priority to U.S. Provisional Patent No. 60/968,326, filed on Aug. 28, 2007, and is a continuation-in-part application of U.S. patent application Ser. No. 11/534,667, filed on Sep. 24, 2006, which claims priority to U.S. Provisional Patent Application No. 60/721,226, filed Sep. 28, 2005, now abandoned.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable

BACKGROUND OF THE INVENTION**1. Field of the Invention**

The present invention relates to a method and system for classification of digital facial images received over wireless digital networks or the Internet and retrieval of information associated with a classified image.

2. Description of the Related Art

Classification of facial images using feature recognition software is currently used by various government agencies such as the Department of Homeland Security (DHS) and the Department of Motor Vehicles (DMV) for detecting terrorists, detecting suspected cases of identity fraud, automating border and passport control, and correcting mistakes in their respective facial image databases. Facial images stored in the DMV or DHS are digitized and stored in centralized databases, along with associated information on the person. Examples of companies that provide biometric facial recognition software include Cross Match Technologies, Cognitec, Cogent Systems, and Iridian Technologies; of these, Cognitec also provides a kiosk for digitally capturing images of people for storage into their software.

Your face is an important part of who you are and how people identify you. Imagine how hard it would be to recognize an individual if all faces looked the same. Except in the case of identical twins, the face is arguably a person's most unique physical characteristic. While humans have had the innate ability to recognize and distinguish different faces for millions of years, computers are just now catching up.

Visionics, a company based in New Jersey, is one of many developers of facial recognition technology. The twist to its particular software, FACEIT, is that it can pick someone's face out of a crowd, extract that face from the rest of the scene and compare it to a database full of stored images. In order for this software to work, it has to know what a basic face looks like. Facial recognition software is based on the ability to first recognize faces, which is a technological feat in itself, and then measure the various features of each face.

If you look in the mirror, you can see that your face has certain distinguishable landmarks. These are the peaks and valleys that make up the different facial features. Visionics defines these landmarks as nodal points. There are about 80 nodal points on a human face. A few of the nodal points that are measured by the FACEIT software: distance between eyes; width of nose; depth of eye sockets; cheekbones; Jaw line; and chin. These nodal points are measured to create a numerical code that represents the face in a database. This code is referred to as a faceprint and only fourteen to twenty-

2

two nodal points are necessary for the FACEIT software to complete the recognition process.

Facial recognition methods may vary, but they generally involve a series of steps that serve to capture, analyze and compare your face to a database of stored images. The basic process that is used by the FACEIT software to capture and compare images is set forth below and involves Detection, Alignment, Normalization, Representation, and Matching. To identify someone, facial recognition software compares newly captured images to databases of stored images to see if that person is in the database.

Detection is when the system is attached to a video surveillance system, the recognition software searches the field of view of a video camera for faces. If there is a face in the view, it is detected within a fraction of a second. A multi-scale algorithm is used to search for faces in low resolution. The system switches to a high-resolution search only after a head-like shape is detected.

Alignment is when a face is detected, the system determines the head's position, size and pose. A face needs to be turned at least thirty-five degrees toward the camera for the system to register the face.

Normalization is when the image of the head is scaled and rotated so that the head can be registered and mapped into an appropriate size and pose. Normalization is performed regardless of the head's location and distance from the camera. Light does not impact the normalization process.

Representation is when the system translates the facial data into a unique code. This coding process allows for easier comparison of the newly acquired facial data to stored facial data.

Matching is when the newly acquired facial data is compared to the stored data and linked to at least one stored facial representation.

The heart of the FACEIT facial recognition system is the Local Feature Analysis (LFA) algorithm. This is the mathematical technique the system uses to encode faces. The system maps the face and creates the faceprint. Once the system has stored a faceprint, it can compare it to the thousands or millions of faceprints stored in a database. Each faceprint is stored as an 84-byte file.

One of the first patents related to facial recognition technology is Rothfjell, U.S. Pat. No. 3,805,238 for a Method For Identifying Individuals using Selected Characteristics Body Curves. Rothfjell teaches an identification system in which major features (e.g. the shape of a person's nose in profile) are extracted from an image and stored. The stored features are subsequently retrieved and overlaid on a current image of the person to verify identity.

Another early facial recognition patent is Himmel, U.S. Pat. No. 4,020,463 for an Apparatus And A Method For Storage And Retrieval Of Image Patterns. Himmel discloses digitizing a scanned image into binary data which is then compressed and then a sequence of coordinates and vector values are generated which describe the skeletonized image. The coordinates and vector values allow for compact storage of the image and facilitate regeneration of the image.

Yet another is Gotanda, U.S. Pat. No. 4,712,103 for a Door Lock Control System. Gotanda teaches, inter alia, storing a digitized facial image in a non-volatile ROM on a key, and retrieving that image for comparison with a current image of the person at the time he/she request access to a secured area. Gotanda describes the use of image compression, by as much as a factor of four, to reduce the amount of data storage capacity needed by the ROM that is located on the key.

Yet another is Lu, U.S. Pat. No. 4,858,000. Lu teaches an image recognition system and method for identifying ones of

US 7,599,527 B2

3

a predetermined set of individuals, each of whom has a digital representation of his or her face stored in a defined memory space.

Yet another is Tal, U.S. Pat. No. 4,975,969. Tal teaches an image recognition system and method in which ratios of facial parameters (which Tal defines as distances between definable points on facial features such as a nose, mouth, eyebrow etc.) are measured from a facial image and are used to characterize the individual. Tal, like Lu in U.S. Pat. No. 4,858,000, uses a binary image to find facial features.

Yet another is Lu, U.S. Pat. No. 5,031,228. Lu teaches an image recognition system and method for identifying ones of a predetermined set of individuals, each of whom has a digital representation of his or her face stored in a defined memory space. Face identification data for each of the predetermined individuals are also stored in a Universal Face Model block that includes all the individual pattern images or face signatures stored within the individual face library.

Still another is Burt, U.S. Pat. No. 5,053,603. Burt teaches an image recognition system using differences in facial features to distinguish one individual from another. Burt's system uniquely identifies individuals whose facial images and selected facial feature images have been learned by the system. Burt's system also "generically recognizes" humans and thus distinguishes between unknown humans and non-human objects by using a generic body shape template.

Still another is Turk et al., U.S. Pat. No. 5,164,992. Turk teaches the use of an Eigenface methodology for recognizing and identifying members of a television viewing audience. The Turk system is designed to observe a group of people and identify each of the persons in the group to enable demographics to be incorporated in television ratings determinations.

Still another is Deban et al., U.S. Pat. No. 5,386,103. Deban teaches the use of an Eigenface methodology for encoding a reference face and storing said reference face on a card or the like, then retrieving said reference face and reconstructing it or automatically verifying it by comparing it to a second face acquired at the point of verification. Deban teaches the use of this system in providing security for Automatic Teller Machine (ATM) transactions, check cashing, credit card security and secure facility access.

Yet another is Lu et al., U.S. Pat. No. 5,432,864. Lu teaches the use of an Eigenface methodology for encoding a human facial image and storing it on an "escort memory" for later retrieval or automatic verification. Lu teaches a method and apparatus for employing human facial image verification for financial transactions.

Technologies provided by wireless carriers and cellular phone manufacturers enable the transmission of facial or object images between phones using Multimedia Messaging Services (MMS) as well as to the Internet over Email (Simple Mail Transfer Protocol, SMTP) and Wireless Access Protocol (WAP). Examples of digital wireless devices capable of capturing and receiving images and text are camera phones provided by Nokia, Motorola, LG, Ericsson, and others. Such phones are capable of handling images as JPEGs over MMS, Email, and WAP across many of the wireless carriers: Cingular, T-Mobile, (GSM/GPRS), and Verizon (CDMA) and others.

Neven, U.S. Patent Publication 2005/0185060, for an Image Base Inquiry system For Search Engines For Mobile Telephones With Integrated Camera, discloses a system using a mobile telephone digital camera to send an image to a server that converts the image into symbolic information, such as plain text, and furnishes the user links associated with the image which are provided by search engines.

4

Neven, et al., U.S. Patent Publication 2006/0012677, for an Image-Based Search Engine For Mobile Phones With Camera, discloses a system that transmits an image of an object to a remote server which generates three confidence values and then only generates a recognition output from the three confidence values, with nothing more. I

Adam et al., U.S. Patent Publication 2006/0050933, for a Single Image Based Multi-Biometric System And Method which integrates face, skin and iris recognition to provide a biometric system.

Until recently, acquiring information about someone from a real-time image has always been the domain of science fiction novels. Recently, the government and large companies (such as casinos) have implemented face recognition systems to identify individuals from a real-time image. However, due to the costs and lack of a database these systems are not available to the individual member of the general public. Further, the present systems rely on the individual being present geographically and an image of the individual being provided on a predetermined database such as government database of images of terrorists or a casino database of images of known "card cheaters."

BRIEF SUMMARY OF THE INVENTION

The present invention provides a novel method and system for providing an individual an expedient, inexpensive and technologically easy means for determining if another individual looks like the individual, essentially determining if an unknown "twin" exists for the individual.

The invention classifies a person, or whom a person most looks like, by preferably using a digital image captured by a wireless communication device (preferably a mobile telephone) or from a personal computer (PC). The image may be in a JPEG, TIFF, GIF or other standard image format. Further, an analog image may be utilized if digitized. The image is sent to the wireless carrier and subsequently sent over the internet to an image classification server. Alternatively, the digital image may be uploaded to a PC from a digital camera or scanner and then sent to the image classification server over the internet.

After an image is received by the image classification server, the image is processed into a feature vector, which reduces the complexity of the digital image data into a small set of variables that represent the features of the image that are of interest for classification purposes.

The feature vector is compared against existing feature vectors in an image database to find the closest match. The image database preferably contains one or more feature vectors for each target individual.

Once classified, an image of the best matching person, possibly manipulated to emphasize matching characteristics, as well as meta-data associated with the person, sponsored information, similar product, inventory or advertisement is sent back to the user's PC or wireless communication device.

A more detailed explanation of a preferred method of the invention is as follows below. The user captures a digital image with a digital camera enabled wireless communication device, such as a mobile telephone. The compressed digital image is sent to the wireless carrier as a multimedia message (MMS), a short message service ("SMS"), an e-mail (Simple Mail Transfer Protocol ("SMTP")), or wireless application protocol ("WAP") upload. The image is subsequently sent over the internet using HTTP or e-mail to an image classification server. Alternatively, the digital image may be uploaded to a PC from a digital camera, or scanner. Once on the PC, the image can be transferred over the Internet to the

US 7,599,527 B2

5

image classification server as an e-mail attachment, or HTTP upload. The user is preferably the provider of the digital image for classification, and includes, but is not limited to a physical person, machine, or software application.

After the image is received by the image classification server, a feature vector is generated for the image. A feature vector is a small set of variables that represent the features of the image that are of interest for classification purposes. Creation and comparison of features vectors may be queued, and scaled across multiple machines. Alternatively, different feature vectors may be generated for the same image. Alternatively, the feature vectors of several images of the same individual may be combined into a single feature vector. The incoming image, as well as associated features vectors, may be stored for later processing, or added to the image database. For faces, possible feature vector variables are the distance between the eyes, the distance between the center of the eyes, to the chin, the size, and shape of the eyebrows, the hair color, eye color, facial hair if any, and the like.

After the feature vector for an image is created, the feature vector is compared against feature vectors in an image database to find the closest match. Preferably, each image in the image database has a feature vector. Alternatively, feature vectors for the image database are created from a set of faces, typically eight or more digital images at slightly different angles for each individual. Since the target individual's feature vector may be generated from several images, an optional second pass is made to find which of the individual images that were used to create the feature vector for the object best match the incoming image.

Once classified, the matching image's name and associated meta-data is retrieved from the database. Before the response is sent, the best-matching image or incoming image may be further manipulated to emphasize the similarities between the two images. This image manipulation can be automated, or can be done interactively by the user. The matching image's name, meta-data, associated

One preferred aspect of the present invention is a method for matching images. The method includes acquiring a facial image of a human. Next, the facial image is transmitted from a sender to a server. Next, the facial image is analyzed at the server to determine if the facial image is acceptable. Next, the facial image is processed to create a processed image. Next, the processed image is compared to a plurality of database processed images. Next, the processed image is matched to a database processed image of the plurality of database processed images to create matched images. Next, a perception value of the matched images is determined at the server site. Then, the matched images and the perception value are transmitted to the sender.

Another aspect of the present invention is a method for matching an image of an individual to an image of an unknown "twin", wherein a twin is defined as similar in appearance of facial features. The method includes wirelessly transmitting a digital facial image of an individual from a mobile communication device over a wireless network to an image classification server. Next, the digital facial image is processed at the image classification server to create a primary feature vector for the digital facial image. Next, the primary feature vector is compared to a plurality of database feature vectors, with each of the plurality of database feature vectors corresponding to a database processed image. Next, a database feature vector is selected that best matches the primary feature vector to create matched images of the digital facial image of the individual and a twin. Next, the matched images are transmitted to the mobile communication device.

6

The twin image can be an image that was sent into the image classification server and added to the plurality of database feature vectors.

Yet another aspect of the present invention is a system for matching an unknown facial image of an individual with an image of a twin. The system includes a mobile communication device, an image classification server and a wireless network. The mobile communication device includes means for generating a digital facial image of an individual and means for wirelessly transmitting the digital facial image. The image classification server has means for receiving the digital facial image from the mobile communication device, means for analyzing the digital facial image, means for processing the digital facial image to generate a processed image, means for comparing the processed image to a plurality of database processed images, means for matching the processed image to a database processed image of the plurality of database processed images to create matched images, means for determining a perception value of the matched images, and means for transmitting the matched images and the confidence value to the mobile communication device. The wireless network allows for transmissions between the mobile communication device and the image classification server.

The processed image is preferably processed as a primary feature vector and the plurality of database processed images is a plurality of database feature vectors. Comparing the processed image to a plurality of database processed images preferably comprises comparing the primary feature vector to each of the plurality of database feature vectors. The primary feature vector and each of the plurality of database feature vectors are preferably based on a plurality of factors comprising facial expression, hair style, hair color, facial pose, eye color, local feature analysis, eigenfaces, principle component analysis, texture of the face, color of the face and facial hair.

The method preferably further comprises web crawling a plurality of Web sites for images of individuals to process each of the images to add to the databases of processed images with each of the images of the databases of processed images having a tag for linking to the Web site pertaining to the image.

Having briefly described the present invention, the above and further objects, features and advantages thereof will be recognized by those skilled in the pertinent art from the following detailed description of the invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a flow chart of a specific method of the present invention.

FIG. 2 is a flow chart of a general method of the present invention.

FIG. 3 is a schematic diagram of a system of the present invention.

FIG. 3A is a schematic representation of the image classification server of the present invention.

FIG. 4 is image and table comparison of an individual's image and an unknown image.

FIG. 5 is a flow chart of a specific method of the present invention.

FIG. 6 is a flow chart of a specific method of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

A flow chart of a method is illustrated in FIG. 1. The method is generally designated 100 and commences with a

US 7,599,527 B2

7

facial image of individual being acquired at block 101. The facial image is acquired preferably using a digital camera of a wireless communication device such as a wireless mobile telephone, personal digital assistant ("PDA") or the like. Alternatively, the facial image is acquired from a PC or the like.

At block 102, the facial image is transmitted over a network to an image classification server, preferably over a wireless network. The facial image is preferably sent to a male or female designation site at the image classification server. The facial image is subsequently sent over the internet using HTTP or e-mail to the image classification server. The facial image, preferably a compressed digital facial image such as a JPEG image, is sent to a wireless carrier as a MMS, a SMS, a SMTP, or WAP upload. Alternatively, the facial image is uploaded to a PC from a digital camera, or scanner and then transferred over the internet to the image classification server as an e-mail attachment, or HTTP upload.

At block 103, the facial image is analyzed at the image classifications server to determine if the facial image is of adequate quality to be processed for matching. Quality issues with the facial image include but are not limited to a poor pose angle, brightness, shading, eyes closed, sunglasses worn, obscured facial features, or the like. At block 104, an image determination is made concerning the quality of the image. A negative image determination is made at block 105. At block 106, a transmission is sent to the sender informing then sender that the facial image provided is inadequate and requesting that the sender provide a new facial image. The matching procedure for such a negative image may continue, and the matched images will be sent with an additional statement informing the sender that the image was of bad quality and that a better match may be possible with a higher quality image.

At block 107, if the facial image is positive, then the facial image is processed at block 108. It should be noted that the facial image is previously unknown to the image classification and is the first time that the facial image has been analyzed by the image classification server. Thus, the method of present invention involves processing an unknown image to find a match with facial images of other individuals, which is unlike typical facial recognition systems which involve matching an image of an individual with a known image of the individual in the database. At block 108, processing of the image preferably comprises using an algorithm which includes a principle component analysis technique to process the face of the facial image into an average of a multitude of faces, otherwise known as the principle component and a set of images that are the variance from the average face image known as the additional components. Each is reconstructed by multiplying the principal components and the additional components against a feature vector and adding the resulting images together. The resulting image reconstructs the original face of the facial image. Processing of the facial image comprises factors such as facial hair, hair style, facial expression, the presence of accessories such as sunglasses, hair color, eye color, and the like. Essentially a primary feature vector is created for the facial image.

At block 109, processed image or primary feature vector is compared to a plurality of database processed images preferably located at the image classification server. During the comparison, the primary feature vector is compared a plurality of database feature vectors which represent the plurality of database processed images. The database preferably includes at least 100,000s of processed images, more preferably at least 1,000,000 processed images, and most preferably from 100,000 processed images to 10,000,000 processed images.

8

Those skilled in the pertinent art will recognize that the database may contain any number of images without departing from the scope and spirit of the present invention. The processed images preferably include multiple images of one individual, typically from two to twenty images, more preferably from four to ten images of a single individual in different poses, different facial expressions, different hair styles and the like. The database of processed images preferably includes other individuals of the public which have sent their image into the image classification server. Again, it should be noted that the facial image sent by the sender is an unknown image which is being best matched to a known image. The database of processed images preferably includes images acquired from social networking Web sites, other publicly accessible Web sites, private Web sites, and government Web sites. These images are preferably obtained working with the owners of the Web site or using a Web crawling or spider program to obtain images and information for processing into feature vectors.

At block 110, the processed image undergoes raw matching of a small plurality of database images with each having a feature vector value that is close to the value of the primary feature vector. At block 110a, the iterative processing of the raw matching is performed wherein the human perception of what is a good match is one of the primary factors in creating the matched images. At block 111, preferably a perception value for the matched images is determined based on the feature vector values. The perception value ranges from 0% to 100%, with 100% being an ideal match. At block 111a, the matches are sorted based on predicted human perception.

At block 112, the matched images and the perception value are transmitted to the sender over a network as discussed above for the initial transmission. The entire process preferably occurs within a time period of sixty seconds, and most preferably within a time of ten seconds. The process may be delayed due to the wireless carrier, and network carrier. In this manner, the sender will know which celebrity the facial image best matches. The output of the matched images and any additional text is preferably sent to the sender's wireless communication device for instantaneous feedback of their inquiry of which celebrity does the facial image look like. Further, the output is also sent to a sender's web page on a web site hosted through the image classification server wherein the sender can control access to the sender's web page and modify the matched images and the additional text. Further, the output is sent to a voting site as discussed below.

At decision 113, the quality of the matched images is determined to decide if the matched images should be sent to voting site on the web site. At block 115, the matched images are sent to the sender's wireless communication device, the sender's web page on the web site for viewing by the sender and other viewers determined by the sender. At block 114, the matched images are sent to the voting site if of sufficient quality, preferably based on the perception value, to be voted upon by visitors to the voting site.

In this manner, a statistical modeling element is added to the matching process to better match images based on human perception as determined by the scores for previously matched images on the voting site. In other embodiments regression analysis or Bayesian analysis is utilized. Under this alternative scenario, a Support Vector Machine, preferably a high-dimensional neural network, with two feature vectors of a match, along with average vote scores collected from viewers of the web site will be utilized to provide better matching of images. A more detailed explanation of a Support Vector Machine is set forth in Cortes & Vapnik, *Support Vector Networks, Machine Learning*, 20, 1995, which is

US 7,599,527 B2

9

hereby incorporated by reference in its entirety. The previous voting patterns are implemented in a statistical model for the algorithm to capture the human perception element to better match images as perceived by humans.

A more general method of the present invention is illustrated in FIG. 2. The general method is designated 150. At block 151, an unknown image from a wireless communication device such as a mobile telephone is transmitted from a sender to an image classification server over a network such as a wireless network with subsequent internet transmission. At block 152, the unknown image is processed to create a primary feature vector such as discussed above. At block 153, the primary feature vector value is compared to a plurality of database feature vectors. At block 154, a database feature vector that best matches the primary feature vector is selected to create matched images. At block 155, the matched images are transmitted to the sender, along with a confidence value and other information about the matching image.

A system of the present invention is illustrated in FIG. 3. The system is generally designated 50. The system 50 preferably comprises a wireless communication device 51, a wireless network 52, an image classification server 53 and a web site 55, not shown, which may be viewed on a computer 54 or alternate wireless communication device 54' with internet access. The wireless communication device preferably comprises means for generating a digital facial image of an individual and means for wirelessly transmitting the digital facial image over a wireless network. The image classification server 53 preferably comprises means for analyzing the digital facial image, means for processing the digital facial image to generate a processed image, means for comparing the processed image to a plurality of database processed images, means for matching the processed image to a database processed image to create matched images, means for determining a perception value, means for applying a statistical model based on human perception as determined by user's votes of previous third party matched images, and means for transmitting the matched images and information to the wireless communication device.

The present invention preferably uses facial recognition software commercially or publicly available such as the FACEIT brand software from IDENTIX, the FACEVACS brand software from COGNETIC, and others. Those skilled in the pertinent art will recognize that there are many facial recognition softwares, including those in the public domain, that may be used without departing from the scope and spirit of the present invention.

The operational components of the image classification server 53 are schematically shown in FIG. 3A. The image classification server 53 preferably comprises an input module 62, transmission engine 63, input feed 64, feature vector database 65, sent images database 66, facial recognition software 67, perception engine 68, output module 69 and the image database 70. The input module 62 is further partitioned into wireless device inputs 62a, e-mail inputs 62b and HTTP (internet) inputs 62c. The output module 69 is further partitioned into wireless device outputs 69a, a sender's web page output 69b and a voting web page output 69c. The feature vector database 65 is the database of processed images of the celebrities from which the previously unknown facial image is matched with one of the processed images. The image database is a database of the actual images from social networking Web sites, other publicly accessible Web sites, private Web sites, and government Web sites which are sent as outputs for the matched images. The sent images database 66 is a database of all of the images sent in from users/senders to

10

be matched with the processed images. The perception engine 68 imparts the human perception processing to the matching procedure.

As shown in FIG. 4, an unknown facial image 80 sent by an individual is matched to a image 75 selected from the database of processed images using a method of the present invention as set forth above. The table provides a comparison of the facial values for each of the images.

The present invention also preferably uses voting results to weigh feature vectors. In addition to using vote results to select which actor images are good for enrollment, vote results can also be used to weigh the feature vector itself so that qualities of the image that are perceived by humans are more heavily weighted when searching for a good match. Biometric security software (Cognitec, Identix, etc.) selects and weighs the features of an image in order to match an image of a person to another image of the same person and optimizing the vector to achieve this result. The feature vector can be made up of local facial features, or overall components of the face as determined by principle component analysis.

The use of human perception voting results in order to optimize the look-a-likeness of a person to a different person can be used, regardless of the how the feature vectors are determined. In other words, the algorithm for determining the set of feature vectors that best represent a face can be augmented with a 2nd algorithm which takes these feature vectors, typically represented as a vector of floating point numbers, and weighs the values in the vector so that the characteristics of the image that are based on human perception are used more heavily. A more detailed explanation of human perception for facial recognition is provided in Myers, et al., U.S. patent application Ser. No. 12/138,559, filed on Jun. 13, 2008, for Image Classification And Information Retrieval Over Wireless Digital Networks And The Internet, which is hereby incorporated by references in its entirety.

Statistical methods such as neural networks or support vector machines (SVMs) can be used to feed the source and actor feature vectors and predict the human perception vote.

The feature vector from the source image and the feature vector from the actor image are feed into a neural network which is trained on the human perception rating for the match. Given many matches and corresponding votes, the neural network can weigh the input vector values, v1, v2, etc. and see which of these feature vector components are statistically relevant to the determination of the human vote or rating.

Once trained, the Neural Network or SVM can predict whether a match is good or not by using the feature vectors, determined from a separate algorithm.

A method 400 for determining an unknown twin for an individual is illustrated in FIG. 5. At block 402, an image of an unknown individual is obtained, using preferably a digital camera, and sent to an image classification server. The individual is unknown to an image classification server. At block 404, a plurality of feature vectors is generated for the image. At block 406, an engine searches an existing database of feature vectors for images to match the image to an unknown twin of the individual. At block 408, the matching twin is located. At block 410, the information is sent to the individual including matching twin images.

A method 500 for determining a twin from a social networking site is shown in FIG. 6. In this method, at block 502, a person acquires an image of an individual, even himself or herself. The first person may take a digital image, for example, using a camera phone on a mobile telephone. At block 504, the image is then sent to a server as discussed above in reference to FIG. 1, where a plurality of feature vectors are generated for the image of the first person. At

US 7,599,527 B2

11

block 506, the server searches publicly accessible websites, such as www.myspace.com, www.facebook.com, and other social networking websites, to find a matching twin for the first person. At block 508, a matching twin is located and information from the website for the unknown individual is captured. Such information may be a URL for the web page of the unknown person, personal information, and other available information. At block 510, the information is transmitted to the first person.

From the foregoing it is believed that those skilled in the pertinent art will recognize the meritorious advancement of this invention and will readily understand that while the present invention has been described in association with a preferred embodiment thereof, and other embodiments illustrated in the accompanying drawings, numerous changes, modification and substitutions of equivalents may be made therein without departing from the spirit and scope of this invention which is intended to be unlimited by the foregoing except as may appear in the following appended claim. Therefore, the embodiments of the invention in which an exclusive property or privilege is claimed are defined in the following appended claims.

We claim as our invention:

1. A method for matching an unknown image of a first individual with an image of another individual that is a twin in appearance to the first individual, the method comprising:
 - acquiring an unknown facial image of a first individual;
 - transmitting the unknown facial image from a sender over a network to a server;
 - analyzing the facial image at the server to determine if the unknown facial image is acceptable;
 - processing the unknown facial image to create a processed image;
 - comparing the processed image to a plurality of database processed images;
 - matching the processed image to a database processed image of the plurality of database processed images to create matched twin images, wherein the database processed image is a facial image of another individual that is a twin in appearance to the first individual;
 - determining a perception value of the matched images;
 - sorting matches based on predicted human perception; and
 - transmitting the best matched images and the perception value to the sender over the network.
2. The method according to claim 1 wherein the processed image is processed as a primary feature vector and the plurality of database processed images is a plurality of database feature vectors, and wherein comparing the processed image to a plurality of database processed images comprises comparing the primary feature vector to each of the plurality of database feature vectors.
3. The method according to claim 2 wherein matching the processed image to a database processed image of the plurality of database processed images to create matched twin images comprises selecting a database feature vector with a value that is most similar to the value of the primary feature vector.
4. The method according to claim 2 wherein comparing the processed image to a plurality of database processed images further comprises applying a statistical model based on human perception as determined by user's votes of previous third party matched images.
5. The method according to claim 2 wherein the primary feature vector and each of the plurality of database feature vectors are based on a plurality of factors comprising facial expression, hair style, hair color, facial pose, eye color, texture of the face, color of the face and facial hair.

12

6. The method according to claim 1 wherein transmitting the unknown facial image from a sender to a server comprises transmitting the unknown facial image to a male server site or a female server site.

7. The method according to claim 1 wherein the unknown facial image is acquired by a digital camera and transmitted from a computer over the internet to the server, or the unknown facial image is acquired by a camera of a mobile telephone and transmitted from the mobile telephone over a wireless network to the server.

8. The method according to claim 1 wherein the unknown facial image is a JPEG image transmitted as a MMS.

9. The method according to claim 8 wherein the matched images and perception value are transmitted from the server over a wireless network to the mobile telephone.

10. The method according to claim 1 wherein the matched twin images and perception value are transmitted to a sender's web page on a web site.

11. The method according to claim 1 wherein analyzing the unknown facial image at the server comprises determining if a plurality of facial image factors are acceptable, the plurality of facial image factors comprising the lack of a facial image, the lack of eyes, uneven lighting, the brightness of the facial image, pose angle of the facial image, relative size of the facial image and pixel strength of the facial image.

12. A method for matching images, the method comprising:

- wirelessly transmitting a digital facial image from a mobile communication device over a wireless network to an image classification server;
- processing the digital facial image at the image classification server to create a primary feature vector for the digital facial image;
- comparing the primary feature vector to a plurality of database feature vectors, each of the plurality of database feature vectors corresponding to a database processed image;
- obtaining matched twin images from the primary feature vector and database feature vectors;
- sorting the matched twin images based on predicted human perception; and
- transmitting the best matched twin images to the mobile communication device.

13. A system for matching an unknown facial image of a first individual with an image of another individual that is a twin in appearance to the first individual, the system comprising:

- a mobile communication device comprising means for generating a digital facial image of an individual and means for wireless transmitting the digital facial image;
- an image classification server for receiving the digital facial image from the mobile communication device, the image classification server comprising
 - means for analyzing the digital facial image,
 - means for processing the digital facial image to generate a processed image,
 - means for comparing the processed image to a plurality of database processed images to create matches,
 - means for sorting the matches based on a predicted human perception to determine the best matched image;
 - means for transmitting the matched images and the perception value to the mobile communication device; and
- a wireless network for transmissions between the mobile communication device and the image classification server.

US 7,599,527 B2

13

14. The system according to claim 13 further comprising means for weighting the voting to provide the predicted human perception.

15. The system according to claim 13 further comprising means for weighting the feature vector.

16. The system according to claim 14 wherein the vote weighting means comprises a support vector machine to input a source feature vector and a celebrity feature vector to predict a human perception vote.

17. The system according to claim 13 further comprising means for determining which feature vectors are relevant to the determination of the predicted human perception.

18. A method of matching an unknown facial image of a first individual with an image of another individual that is a twin in appearance to the first individual, the method comprising:

acquiring an unknown facial image of a first individual;
transmitting the unknown facial image from a sender over a network to a server;
analyzing the facial image at the server to determine if the unknown facial image is acceptable;
processing the unknown facial image to create a processed image;

14

comparing the processed image to a plurality of database processed images;

matching the processed image to a database processed image of the plurality of database processed images to create matched images, wherein the database processed image is a facial image of another individual from the another individual's web page of a publicly available website, the web page containing personal information of the individual and a uniform resource locator for the web page;

transmitting the database processed image, the personal information of the individual and the uniform resource locator for the web page to the sender over the network.

19. The method according to claim 18 wherein the publicly available website is www.MySpace.com or www.facebook.com.

20. The method according to claim 18 wherein the personal information of the another individual comprises the another individual's name, address, telephone number, email address, age, school, friends, favorite entertainments and favorite foods.

* * * * *

EXHIBIT B

FACEDOUBLE, INC. – COMPLAINT FOR PATENT INFRINGEMENT



US007668348B2

(12) **United States Patent**
Shah et al.

(10) **Patent No.:** **US 7,668,348 B2**
(45) **Date of Patent:** ***Feb. 23, 2010**

(54) **IMAGE CLASSIFICATION AND INFORMATION RETRIEVAL OVER WIRELESS DIGITAL NETWORKS AND THE INTERNET**

(75) Inventors: **Alex Shah**, San Diego, CA (US);
Charles A Myers, La Jolla, CA (US)

(73) Assignee: **FaceDouble Corporation**, San Diego, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(56) **References Cited**
U.S. PATENT DOCUMENTS

3,805,238 A	4/1974	Rothfjell
4,020,463 A	4/1977	Himmel
4,712,103 A	12/1987	Gotanda
4,858,000 A	8/1989	Lu
4,975,969 A	12/1990	Tal
5,031,228 A	7/1991	Lu
5,063,603 A	11/1991	Burt
5,164,992 A	11/1992	Turk et al.
5,386,103 A	1/1995	DeBan et al.
5,432,864 A	7/1995	Lu et al.

(Continued)

(21) Appl. No.: **12/267,554**

(22) Filed: **Nov. 7, 2008**

Primary Examiner—Kanji Patel
(74) *Attorney, Agent, or Firm*—Clause Eight IPS; Michael Catania

(65) **Prior Publication Data**

US 2009/0116704 A1 May 7, 2009

Related U.S. Application Data

(63) Continuation of application No. 11/534,667, filed on Sep. 24, 2006, now Pat. No. 7,450,740.

(60) Provisional application No. 60/721,226, filed on Sep. 28, 2005.

(51) **Int. Cl.**
G06K 9/00 (2006.01)
H04M 1/66 (2006.01)
G06F 7/00 (2006.01)

(52) **U.S. Cl.** **382/118; 455/410; 707/104.1**

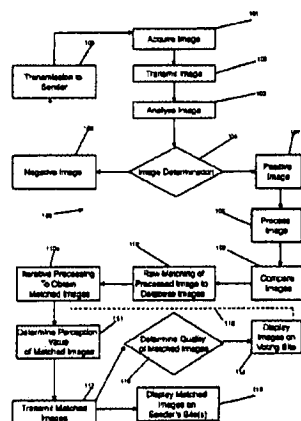
(58) **Field of Classification Search** **382/115-118, 382/181, 218, 232, 260, 305, 312; 707/104.1; 455/410**

See application file for complete search history.

(57) **ABSTRACT**

The invention provides a internet hosted system to find, compare, contrast and identify similar characteristics among two or more individuals or objects using a digital camera, cellular telephone camera, wireless device for the purpose of returning information regarding similar objects or faces to the user. The system features classification of images from a variety of Internet accessible sources, including mobile phones, wireless camera-enabled devices, images obtained from digital cameras or scanners that are uploaded from PCs, third-party applications and databases. Once classified, the matching person's name, or the matching object, image and associated meta-data is sent back to the user. The image may be manipulated to emphasize similar characteristics between the received facial image and the matching facial image. The meta-data sent down with the image may include sponsored links and advertisements.

20 Claims, 5 Drawing Sheets



US 7,668,348 B2

Page 2

U.S. PATENT DOCUMENTS

6,072,894 A	6/2000	Payne	7,130,454 B1	10/2006	Berube et al.
6,430,306 B2	8/2002	Slocum et al.	7,183,895 B2 *	2/2007	Razakos et al. 340/5.7
6,675,145 B1	1/2004	Yehia et al.	7,209,653 B2 *	4/2007	Umeda 396/661
6,698,653 B1 *	3/2004	Diamond et al. 235/375	7,221,931 B2	5/2007	Benco et al.
6,765,470 B2	7/2004	Shinzaki	7,289,647 B2 *	10/2007	Cote 382/118
6,882,741 B2	4/2005	Dobashi et al.	7,495,571 B2 *	2/2009	Charren et al. 340/573.4
6,919,892 B1	7/2005	Cheiky et al.	2002/0118195 A1	8/2002	Paetzold et al.
6,961,466 B2	11/2005	Imagawa et al.	2003/0034978 A1	2/2003	Buddemeier et al.
6,970,580 B2	11/2005	Kies	2004/0151349 A1	8/2004	Milne et al.
6,976,629 B2	12/2005	Carlson	2005/0043897 A1	2/2005	Meyer
7,039,221 B1	5/2006	Tumey et al.	2005/0058320 A1	3/2005	Rhoads et al.
7,050,635 B2	5/2006	Javidi et al.	2005/0076004 A1	4/2005	Yanagisawa et al.
7,095,879 B2	8/2006	Yan et al.	2005/0097131 A1	5/2005	Benco et al.
7,123,754 B2	10/2006	Matsuo et al.	2005/0162523 A1	7/2005	Darrell et al.
7,123,783 B2	10/2006	Gargasha et al.	2005/0182729 A1	8/2005	Kananen
7,124,066 B2	10/2006	Marschner et al.	2005/0185060 A1	8/2005	Neven
7,127,086 B2	10/2006	Yuasa et al.	2005/0275506 A1	12/2005	Otsuka
7,127,087 B2	10/2006	Huang et al.	2006/0012677 A1	1/2006	Neven et al.
			2006/0050933 A1	3/2006	Adam et al.

* cited by examiner

U.S. Patent

Feb. 23, 2010

Sheet 1 of 5

US 7,668,348 B2

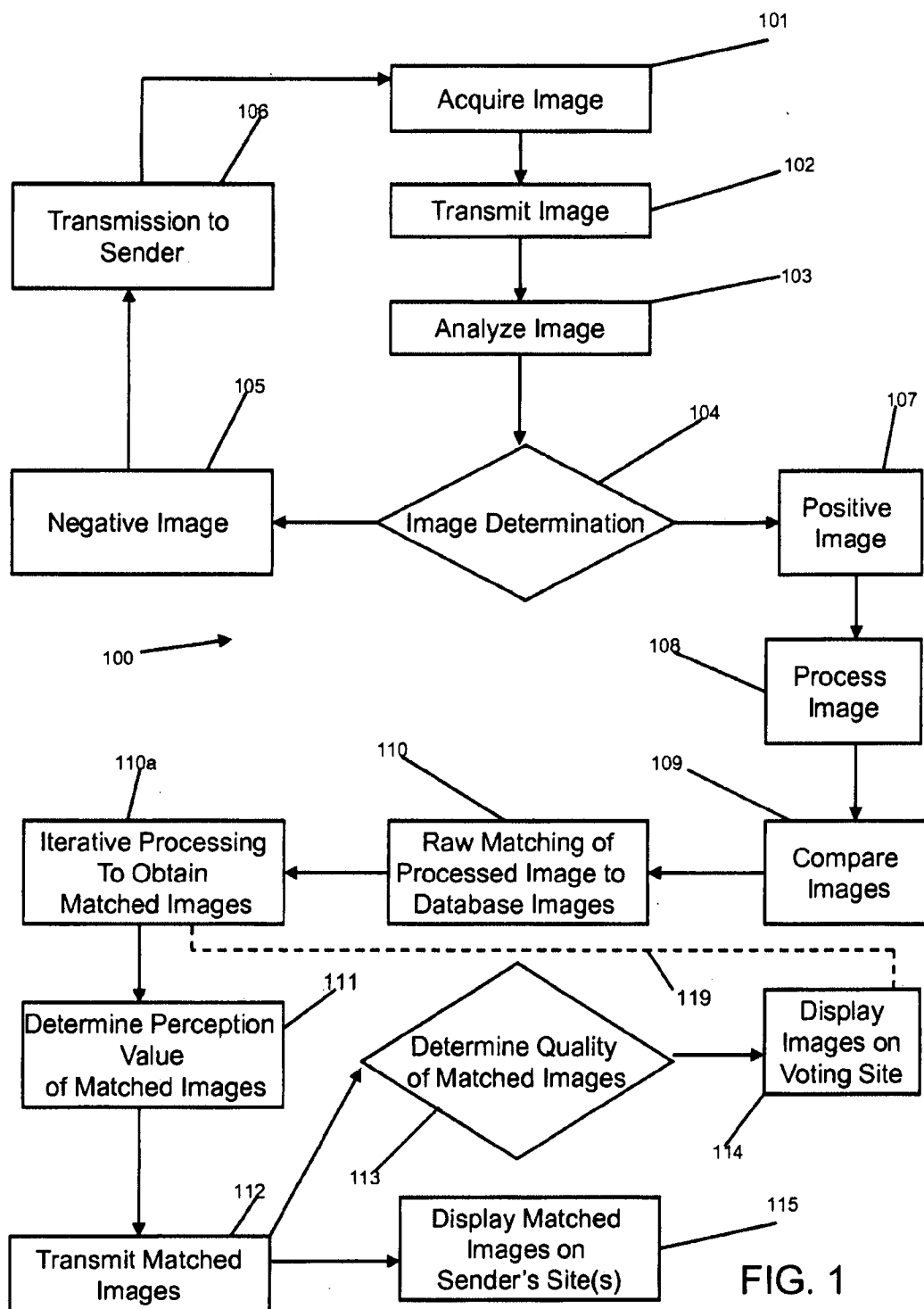


FIG. 1

U.S. Patent

Feb. 23, 2010

Sheet 2 of 5

US 7,668,348 B2

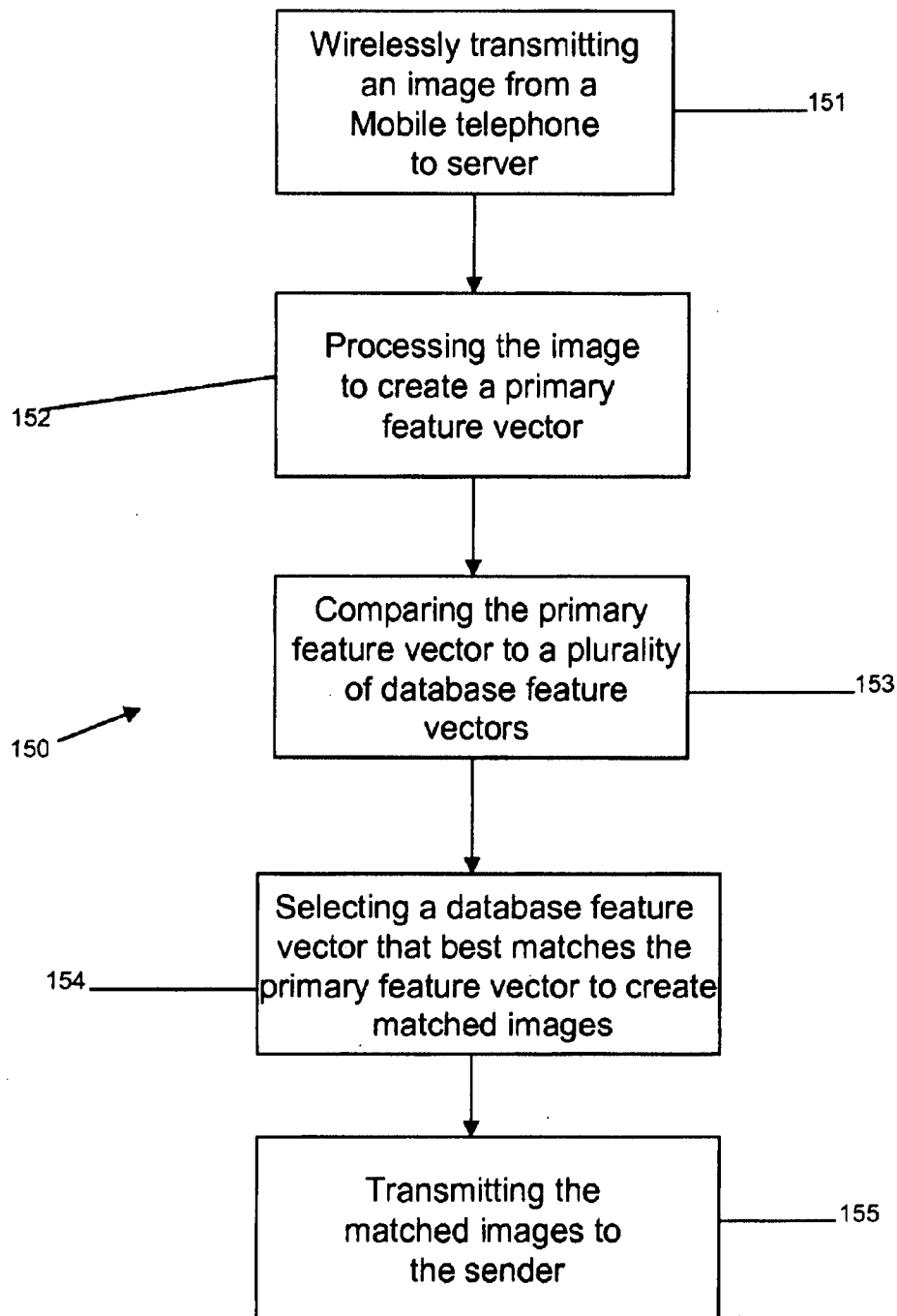


FIG. 2

U.S. Patent

Feb. 23, 2010

Sheet 3 of 5

US 7,668,348 B2

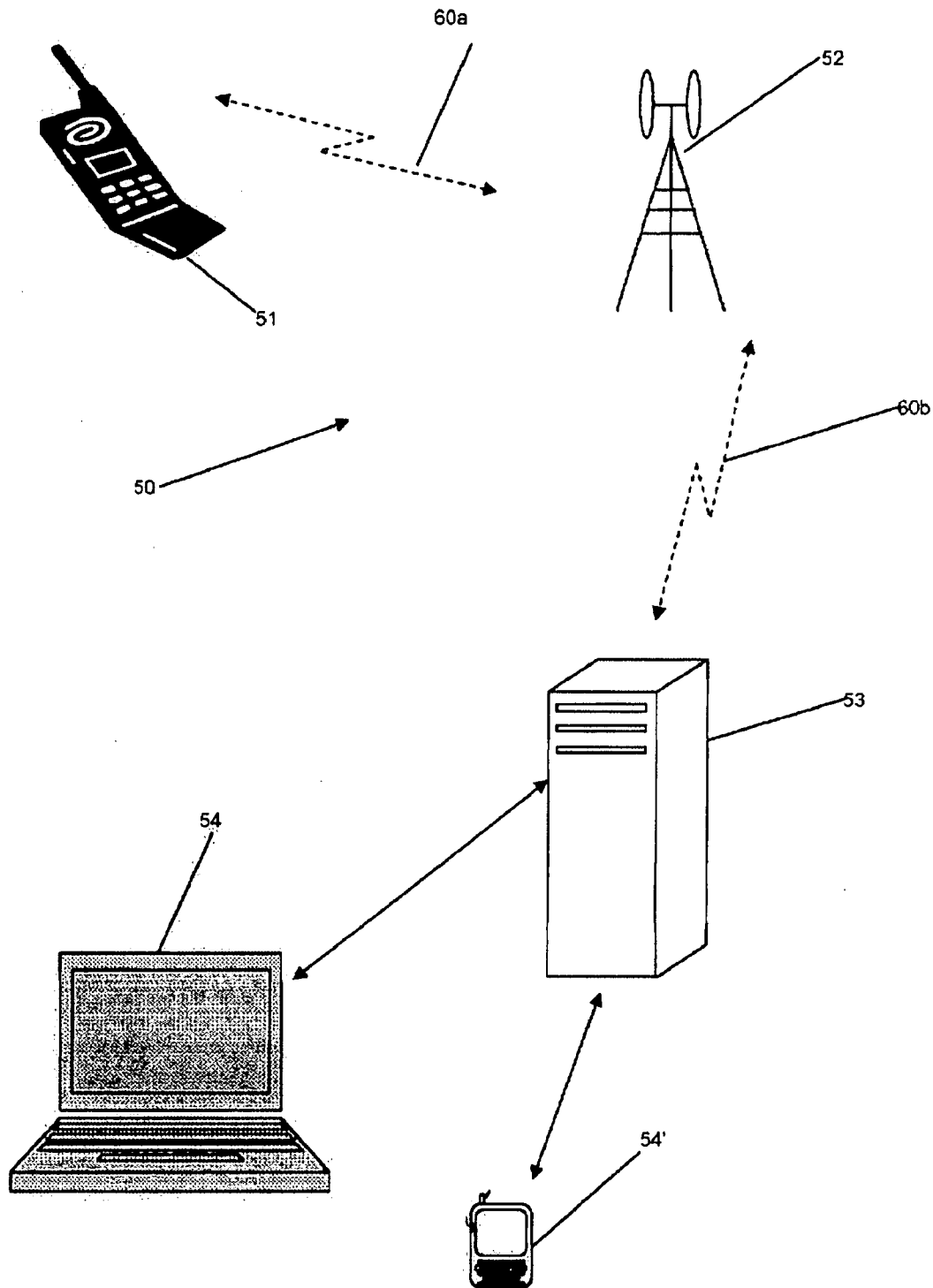


FIG. 3

U.S. Patent

Feb. 23, 2010

Sheet 4 of 5

US 7,668,348 B2

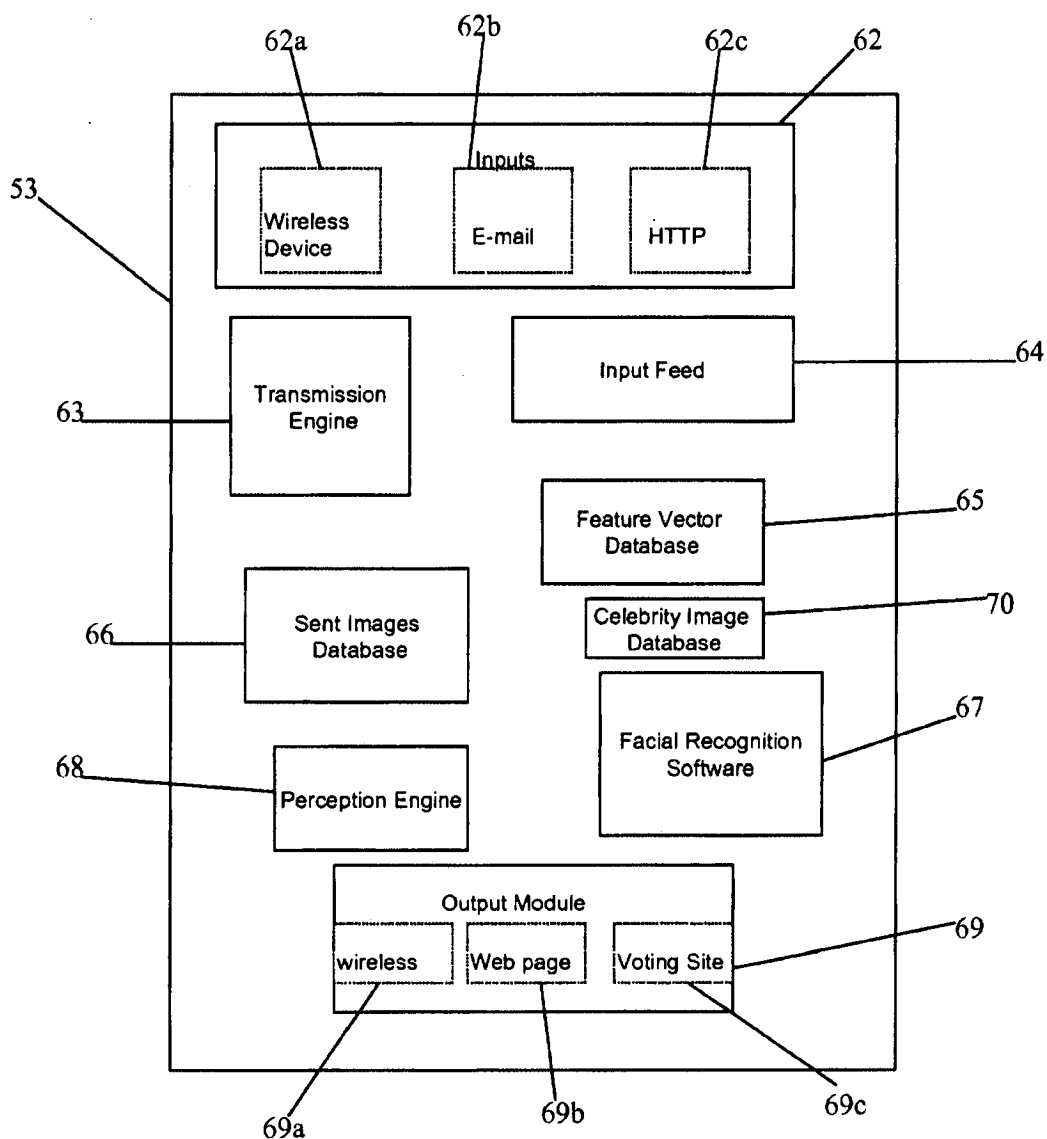


FIG. 3A

U.S. Patent

Feb. 23, 2010

Sheet 5 of 5

US 7,668,348 B2

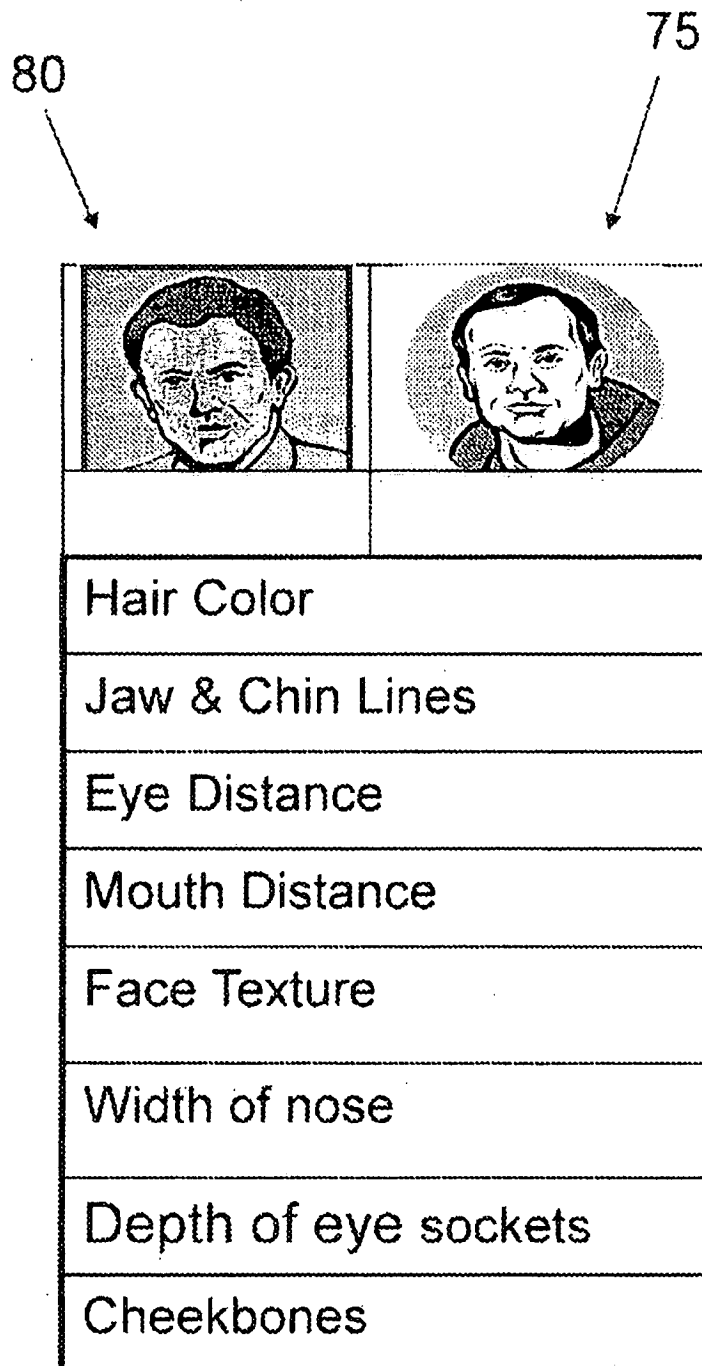


FIG. 4

US 7,668,348 B2

1

IMAGE CLASSIFICATION AND INFORMATION RETRIEVAL OVER WIRELESS DIGITAL NETWORKS AND THE INTERNET

CROSS REFERENCES TO RELATED APPLICATIONS

The Present application claims priority to U.S. patent application Ser. No. 11/534,667, filed on Sep. 24, 2006, which claims priority to U.S. Provisional Patent Application No. 60/721,226, filed Sep. 28, 2005, now abandoned.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method and system for classification of digital facial images over wireless digital networks or the Internet and retrieval of information associated with classified images.

2. Description of the Related Art

Classification of facial images using feature recognition software is currently used by various government agencies such as the Department of Homeland Security (DHS) and the Department of Motor Vehicles (DMV) for detecting terrorists, detecting suspected cases of identity fraud, automating border and passport control, and correcting mistakes in their respective facial image databases. Facial images stored in the DMV or DHS are digitized and stored in centralized databases, along with associated information on the person. Examples of companies that provide biometric facial recognition software include Cross Match Technologies, Cognitec, Cogent Systems, and Iridian Technologies; of these, Cognitec also provides a kiosk for digitally capturing images of people for storage into their software.

Your face is an important part of who you are and how people identify you. Imagine how hard it would be to recognize an individual if all faces looked the same. Except in the case of identical twins, the face is arguably a person's most unique physical characteristic. While humans have had the innate ability to recognize and distinguish different faces for millions of years, computers are just now catching up.

Visionics, a company based in New Jersey, is one of many developers of facial recognition technology. The twist to its particular software, FACEIT, is that it can pick someone's face out of a crowd, extract that face from the rest of the scene and compare it to a database full of stored images. In order for this software to work, it has to know what a basic face looks like. Facial recognition software is based on the ability to first recognize faces, which is a technological feat in itself, and then measure the various features of each face.

If you look in the mirror, you can see that your face has certain distinguishable landmarks. These are the peaks and valleys that make up the different facial features. Visionics defines these landmarks as nodal points. There are about 80 nodal points on a human face. A few of the nodal points that are measured by the FACEIT software: distance between eyes; width of nose; depth of eye sockets; cheekbones; Jaw line; and chin. These nodal points are measured to create a numerical code that represents the face in a database. This code is referred to as a faceprint and only fourteen to twenty-

2

two nodal points are necessary for the FACEIT software to complete the recognition process.

Facial recognition methods may vary, but they generally involve a series of steps that serve to capture, analyze and compare your face to a database of stored images. The basic process that is used by the FACEIT software to capture and compare images is set forth below and involves Detection, Alignment, Normalization, Representation, and Matching. To identify someone, facial recognition software compares newly captured images to databases of stored images to see if that person is in the database.

Detection is when the system is attached to a video surveillance system, the recognition software searches the field of view of a video camera for faces. If there is a face in the view, it is detected within a fraction of a second. A multi-scale algorithm is used to search for faces in low resolution. The system switches to a high-resolution search only after a head-like shape is detected.

Alignment is when a face is detected, the system determines the head's position, size and pose. A face needs to be turned at least thirty-five degrees toward the camera for the system to register the face.

Normalization is when the image of the head is scaled and rotated so that the head can be registered and mapped into an appropriate size and pose. Normalization is performed regardless of the head's location and distance from the camera. Light does not impact the normalization process.

Representation is when the system translates the facial data into a unique code. This coding process allows for easier comparison of the newly acquired facial data to stored facial data.

Matching is when the newly acquired facial data is compared to the stored data and linked to at least one stored facial representation.

The heart of the FACEIT facial recognition system is the Local Feature Analysis (LFA) algorithm. This is the mathematical technique the system uses to encode faces. The system maps the face and creates the faceprint. Once the system has stored a faceprint, it can compare it to the thousands or millions of faceprints stored in a database. Each faceprint is stored as an 84-byte file.

Early facial recognition technology taught an identification system in which major features (e.g. the shape of a person's nose in profile) are extracted from an image and stored. The stored features are subsequently retrieved and overlaid on a current image of the person to verify identity.

Other early facial recognition taught digitizing a scanned image into binary data which is then compressed and then a sequence of coordinates and vector values are generated which describe the skeletonized image. The coordinates and vector values allow for compact storage of the image and facilitate regeneration of the image.

Technologies provided by wireless carriers and cellular phone manufacturers enable the transmission of facial or object images between phones using Multimedia Messaging Services (MMS) as well as to the Internet over Email (Simple Mail Transfer Protocol, SMTP) and Wireless Access Protocol (WAP). Examples of digital wireless devices capable of capturing and receiving images and text are camera phones provided by Nokia, Motorola, LG, Ericsson, and others. Such phones are capable of handling images as JPEGs over MMS, Email, and WAP across many of the wireless carriers: Cingular, T-Mobile, (GSM/GPRS), and Verizon (CDMA) and others.

Neven, U.S. Patent Publication 2005/0185060, for an Image Base Inquiry system For Search Engines For Mobile Telephones With Integrated Camera, discloses a system using

US 7,668,348 B2

3

a mobile telephone digital camera to send an image to a server that converts the image into symbolic information, such as plain text, and furnishes the user links associated with the image which are provided by search engines.

Yanagisawa, et al., U.S. Patent Publication Number 2005/0076004, is directed at generating a database for an electronic picture book database to provide information on photographed plants and flowers.

Kanarat, U.S. Patent Publication Number 2003/0130035 teaches a stand-alone amusement device which matches images of different humans. Kanarat teaches matching facial images based on attractiveness.

Kim, et al., U.S. Pat. No. 7,298,931, is based on matching a query image with database images using an iterative process.

Meyer, U.S. Patent Publication Number 2005/0043897, is based on using photos submitted over the Internet or by mail to match an image to a database of images to provide a user a number of images to select a matching image.

The general public has a fascination with celebrities and many members of the general public use celebrities as a standard for judging some aspect of their life. Many psychiatrists and psychologists believe the confluence of forces coming together in technology and media have led to this celebrity worship factor in our society. One output of this celebrity factor has been a universal approach to compare or determine that someone looks like a certain celebrity. People are constantly stating that someone they meet or know looks like a celebrity, whether it is true or not. What would be helpful would be to scientifically provide a basis for someone to lay claim as looking like a certain celebrity.

BRIEF SUMMARY OF THE INVENTION

The present invention provides a novel method and system for providing the general public an expedient, inexpensive and technologically easy means for determining which celebrity someone looks like.

The invention classifies a person, or whom a person most looks like, by preferably using a digital image captured by a wireless communication device (preferably a mobile telephone) or from a personal computer (PC). The image may be in a JPEG, TIFF, GIF or other standard image format. Further, an analog image may be utilized if digitized. An example is which celebrity most resembles the image that was sent to the application and can be viewed by the user either through their wireless communication device or through a website. The image is sent to the wireless carrier and subsequently sent over the internet to an image classification server. Alternatively, the digital image may be uploaded to a PC from a digital camera or scanner and then sent to the image classification server over the internet.

After an image is received by the image classification server, the image is processed into a feature vector, which reduces the complexity of the digital image data into a small set of variables that represent the features of the image that are of interest for classification purposes.

The feature vector is compared against existing feature vectors in an image database to find the closest match. The image database preferably contains one or more feature vectors for each target individual.

Once classified, an image of the best matching person, possibly manipulated to emphasize matching characteristics, as well as meta-data associated with the person, sponsored information, similar product, inventory or advertisement is sent back to the user's PC or wireless communication device.

4

A more detailed explanation of a preferred method of the invention is as follows below. The user captures a digital image with a digital camera enabled wireless communication device, such as a mobile telephone. The compressed digital image is sent to the wireless carrier as a multimedia message (MMS), a short message service ("SMS"), an e-mail (Simple Mail Transfer Protocol ("SMTP")), or wireless application protocol ("WAP") upload. The image is subsequently sent over the internet using HTTP or e-mail to an image classification server. Alternatively, the digital image may be uploaded to a PC from a digital camera, or scanner. Once on the PC, the image can be transferred over the internet to the image classification server as an e-mail attachment, or HTTP upload. The user is the provider of the digital image for classification, and includes, but is not limited to a physical person, machine, or software application.

After the image is received by the image classification server, a feature vector is generated for the image. A feature vector is a small set of variables that represent the features of the image that are of interest for classification purposes. Creation and comparison of features vectors may be queued, and scaled across multiple machines. Alternatively, different feature vectors may be generated for the same image. Alternatively, the feature vectors of several images of the same individual may be combined into a single feature vector. The incoming image, as well as associate features vectors, may be stored for later processing, or added to the image database. For faces, possible feature vector variables are the distance between the eyes, the distance between the center of the eyes, to the chin, the size, and shape of the eyebrows, the hair color, eye color, facial hair if any, and the like.

After the feature vector for an image is created, the feature vector is compared against feature vectors in an image database to find the closest match. Preferably, each image in the image database has a feature vector. Alternatively, feature vectors for the image database are created from a set of faces, typically eight or more digital images at slightly different angles for each individual. Since the target individual's feature vector may be generated from several images, an optional second pass is made to find which of the individual images that were used to create the feature vector for the object best match the incoming image.

Once classified, the matching image's name and associated meta-data is retrieved from the database. Before the response is sent, the best-matching image or incoming image may be further manipulated to emphasize the similarities between the two images. This image manipulation can be automated, or can be done interactively by the user. The matching image's name, meta-data, associated image, and a copy of the incoming image are then sent back to the user's wireless communication device or PC, and also to a web page for the user.

One aspect of the present invention is a method for matching an unknown image of an individual with a known image of another individual. The method includes acquiring an unknown digital facial image of an individual human. The method also includes wirelessly transmitting the unknown digital facial image from a mobile communication device of a sender over a wireless network to a server. The method also includes analyzing the unknown digital facial image at the server to determine if a plurality of facial image factors are acceptable. The plurality of facial image factors comprises the lack of a facial image, the lack of eyes, uneven lighting, the brightness of the facial image, pose angle of the facial image, relative size of the facial image and pixel strength of the facial image. The method also includes processing the unknown digital facial image to create a processed image having a primary feature vector. The method also includes

US 7,668,348 B2

5

comparing the primary feature vector of the processed image to a plurality of database feature vectors corresponding to a plurality of database processed images and applying a statistical model based on human perception as determined by votes of a plurality of previous third party matched images. The method also includes matching the processed image to a database processed image of the plurality of database processed images to create matched images, wherein the database processed image is based on a digital facial image of another individual human. The method also includes determining a perception value of the matched images, the perception value based on human perception of a plurality of human facial feature vectors. The method also includes wirelessly transmitting the matched images and the perception value to the mobile communication device of the sender over the wireless network.

Another aspect of the present invention is a method for matching an unknown image to an image of a celebrity. The method includes wirelessly transmitting an unknown digital facial image of an individual from a mobile communication device over a wireless network to an image classification server. Next, the digital facial image is processed at the image classification server to create a primary feature vector for the digital facial image. Next, the primary feature vector is compared to a plurality of database feature vectors, with each of the plurality of database feature vectors corresponding to a database processed image. Next, a database feature vector is selected that best matches the primary feature vector to create matched images of the unknown digital facial image of the individual and a celebrity. Next, the matched images are transmitted to the mobile communication device.

Yet another aspect of the present invention is a system for matching an unknown facial image of an individual with an image of a celebrity. The system includes a mobile communication device, an image classification server and a wireless network. The mobile communication device includes means for generating a digital facial image of an individual and means for wirelessly transmitting the digital facial image. The image classification server has means for receiving the digital facial image from the mobile communication device, means for analyzing the digital facial image, means for processing the digital facial image to generate a processed image, means for comparing the processed image to a plurality of database processed images, means for matching the processed image to a database processed image of the plurality of database processed images to create matched images, means for determining a perception value of the matched images, and means for transmitting the matched images and the confidence value to the mobile communication device. The wireless network allows for transmissions between the mobile communication device and the image classification server.

One object is to provide a system using a digitally stored image to find, compare, contrast and identify similar characteristics among two or more individuals. The image can be produced by a digital camera, or digitally scanned from an original, analog image.

Another object is that the system uses the transfer of the image to an application and database accessed via the internet, TCP/IP, WAP, MMS, SMS, or SMTP.

Yet another object is that the internet accessible application is completed via a connection to the internet by a multitude of methods, including but not limited to web browser, WAP Browser, MMS, SMS, and SMTP.

Yet another object is that the image is processed to identify using off-the shelf feature vector recognition software (or as may be developed in the future) and compared with a data-

6

base of one or more, or a plurality of feature vectors. The database of feature vectors is generated from other images or sources.

Yet another object is that the results of the image comparisons are then displayed to the user by accessing the internet through a web browser, WAP browser, or pushed down to the user using MMS, SMS, and SMTP.

Yet another object is that the browser accessible original image and/or the resulting image matches or comparisons can be viewed by the user using either an internet connected browser, a wireless communication device or through a terminal.

Yet another object is that the application can compare or contrast any plurality of available images. The user may chose the database of images to compare including those made available by the host, created by the user or supplied by third parties.

Yet another object is that the resulting information provided to the user may include third party information, advertisements, banners, pop-ups, or click-through.

Yet another object is that the system can determine the closest match for the user's submitted digital facial image against a database of celebrities, including, but not limited to actors, actresses, musicians, athletes, models, and government officials.

Having briefly described the present invention, the above and further objects, features and advantages thereof will be recognized by those skilled in the pertinent art from the following detailed description of the invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a flow chart of a specific method of the present invention.

FIG. 2 is a flow chart of a general method of the present invention.

FIG. 3 is a schematic diagram of a system of the present invention.

FIG. 3A is a schematic representation of the image classification server of the present invention.

FIG. 4 is image and table comparison of an unknown image and a celebrity image.

DETAILED DESCRIPTION OF THE INVENTION

A flow chart of a preferred specific method of the present invention is illustrated in FIG. 1. The method is generally designated 100 and commences with a facial image of individual being acquired at block 101. The facial image is acquired preferably using a digital camera of a wireless communication device such as a wireless mobile telephone, personal digital assistant ("PDA") or the like. Alternatively, the facial image is acquired from a PC or the like.

At block 102, the facial image is transmitted over a network to an image classification server, preferably over a wireless network. The facial image is preferably sent to a male or female designation site at the image classification server. The facial image is subsequently sent over the internet using HTTP or e-mail to the image classification server. The facial image, preferably a compressed digital facial image such as a JPEG image, is sent to a wireless carrier as a MMS, a SMS, a SMTP, or WAP upload. Alternatively, the facial image is uploaded to a PC from a digital camera, or scanner and then transferred over the internet to the image classification server as an e-mail attachment, or HTTP upload.

US 7,668,348 B2

7

At block 103, the facial image is analyzed at the image classification server to determine if the facial image is of adequate quality to be processed for matching. Quality issues with the facial image include but are not limited to a poor pose angle, brightness, shading, eyes closed, sunglasses worn, obscured facial features, or the like. At block 104, an image determination is made concerning the quality of the image. A negative image determination is made at block 105. At block 106, a transmission is sent to the sender informing then sender that the facial image provided is inadequate and requesting that the sender provide a new facial image. The matching procedure for such a negative image may continue, and the matched images will be sent with an additional statement informing the sender that the image was of bad quality and that a better match may be possible with a higher quality image.

At block 107, if the facial image is positive, then the facial image is processed at block 108. It should be noted that the facial image is previously unknown to the image classification and is the first time that the facial image has been analyzed by the image classification server. Thus, the method of present invention involves processing an unknown image to find a match with facial images of other individuals, which is unlike typical facial recognition systems which involve matching an image of an individual with a known image of the individual in the database. At block 108, processing of image preferably comprises using an algorithm which includes a principle component analysis technique to process the face of the facial image into an average of a multitude of faces, otherwise known as the principle component and a set of images that are the variance from the average face image known as the additional components. Each is reconstructed by multiplying the principal components and the additional components against a feature vector and adding the resulting images together. The resulting image reconstructs the original face of the facial image. Processing of the facial image comprises factors such as facial hair, hair style, facial expression, the presence of accessories such as sunglasses, hair color, eye color, and the like. Essentially a primary feature vector is created for the facial image.

At block 109, processed image or primary feature vector is compared to a plurality of database processed images preferably located at the image classification server. During the comparison, the primary feature vector is compared a plurality of database feature vectors which represent the plurality of database processed images. The database preferably includes at least 10,000 processed images, more preferably at least 50,000 processed images, and most preferably from 50,000 processed images to 100,000 processed images. Those skilled in the pertinent art will recognize that the database may contain any number of images without departing from the scope and spirit of the present invention. The processed images preferably include multiple images of one individual, typically from two to twenty images, more preferably from four to ten images of a single individual in different poses, different facial expressions, different hair styles and the like. The database of processed images preferably includes celebrities, including, but not limited to actors, actresses, musicians, athletes, models, government officials, and other publicly well-known individuals. Again, it should be noted that the facial image sent by the sender is an unknown image which is being best matched to a known image.

At block 110, the processed image undergoes raw matching of a small plurality of database images with each having a feature vector value that is close to the value of the primary feature vector. At block 110a, the iterative processing of the raw matching is performed wherein the human perception of

8

what is a good match is one of the primary factors in creating the matched images. At block 111, a perception value for the matched images is determined based on the feature vector values. The perception value ranges from 0% to 100%, with 100% being an ideal match.

At block 112, the matched images and the perception value are transmitted to the sender over a network as discussed above for the initial transmission. The entire process preferably occurs within a time period of sixty seconds, and most preferably within a time of ten seconds. The process may be delayed due to the wireless carrier, and network carrier. In this manner, the sender will know which celebrity the facial image best matches. The output of the matched images and any additional text is preferably sent to the sender's wireless communication device for instantaneous feedback of their inquiry of which celebrity does the facial image look like. Further, the output is also sent to a sender's web page on a web site hosted through the image classification server wherein the sender can control access to the sender's web page and modify the matched images and the additional text. Further, the output is sent to a voting site as discussed below.

At decision 113, the quality of the matched images is determined to decide if the matched images should be sent to voting site on the web site. At block 115, the matched images are sent to the sender's wireless communication device, the sender's web page on the web site for viewing by the sender and other viewers determined by the sender. At block 114, the matched images are sent to the voting site if of sufficient quality, preferably based on the perception value, to be voted upon by visitors to the voting site.

In this manner, a statistical modeling element is added to the matching process to better match images based on human perception as determined by the scores for previously matched images on the voting site. In other embodiments regression analysis or Bayesian analysis is utilized. Under this alternative scenario, a Support Vector Machine, preferably a high-dimensional neural network, with two feature vectors of a match, along with average vote scores collected from viewers of the web site will be utilized to provide better matching of images. A more detailed explanation of a Support Vector Machine is set forth in Cortes & Vapnik, *Support Vector Networks, Machine Learning*, 20, 1995, which is hereby incorporated by reference in its entirety. The previous voting patterns are implemented in a statistical model for the algorithm to capture the human perception element to better match images as perceived by humans.

A more general method of the present invention is illustrated in FIG. 2. The general method is designated 150. At block 151, an unknown image from a wireless communication device such as a mobile telephone is transmitted from a sender to an image classification server over a network such as a wireless network with subsequent internet transmission. At block 152, the unknown image is processed to create a primary feature vector such as discussed above. At block 153, the primary feature vector value is compared to a plurality of database feature vectors. At block 154, a database feature vector that best matches the primary feature vector is selected to create matched images. At block 155, the matched images are transmitted to the sender, along with a confidence value and other information about the matching image.

A system of the present invention is illustrated in FIG. 3. The system is generally designated 50. The system 50 preferably comprises a wireless communication device 51, a wireless network 52, an image classification server 53 and a web site 55, not shown, which may be viewed on a computer 54 or alternate wireless communication device 54' with internet access. The wireless communication device preferably

US 7,668,348 B2

9

comprises means for generating a digital facial image of an individual and means for wirelessly transmitting the digital facial image over a wireless network. The image classification server 53 preferably comprises means for analyzing the digital facial image, means for processing the digital facial image to generate a processed image, means for comparing the processed image to a plurality of database processed images, means for matching the processed image to a database processed image to create matched images, means for determining a perception value, means for applying a statistical model based on human perception as determined by user's votes of previous third party matched images, and means for transmitting the matched images and the perception value to the wireless communication device.

The present invention preferably uses facial recognition software commercially or publicly available such as the FACEIT brand software from IDENTIX, the FACEVACS brand software from COGNETIC, and others. Those skilled in the pertinent art will recognize that there are many facial recognition softwares, including those in the public domain, that may be used without departing from the scope and spirit of the present invention.

The operational components of the image classification server 53 are schematically shown in FIG. 3A. The image classification server 53 preferably comprises an input module 62, transmission engine 63, input feed 64, feature vector database 65, sent images database 66, facial recognition software 67, perception engine 68, output module 69 and the celebrity image database 70. The input module 62 is further partitioned into wireless device inputs 62a, e-mail inputs 62b and HTTP (internet) inputs 62c. The output module 69 is further partitioned into wireless device outputs 69a, a sender's web page output 69b and a voting web page output 69c. The feature vector database 65 is the database of processed images of the celebrities from which the previously unknown facial image is matched with one of the processed images. The celebrity image database is a database of the actual images of celebrities which are sent as outputs for the matched images. Such image databases are commercially available from sources such as Photorazzi. The sent images database 66 is a database of all of the images sent in from users/senders to be matched with the processed images. The perception engine 68 imparts the human perception processing to the matching procedure.

As shown in FIG. 4, an unknown facial image 80 sent by an individual is matched to a celebrity image 75 selected from the database of processed images using a method of the present invention as set forth above. The table provides a comparison of the facial values for each of the images.

From the foregoing it is believed that those skilled in the pertinent art will recognize the meritorious advancement of this invention and will readily understand that while the present invention has been described in association with a preferred embodiment thereof, and other embodiments illustrated in the accompanying drawings, numerous changes modification and substitutions of equivalents may be made therein without departing from the spirit and scope of this invention which is intended to be unlimited by the foregoing except as may appear in the following appended claim. Therefore, the embodiments of the invention in which an exclusive property or privilege is claimed are defined in the following appended claims.

We claim as our invention:

1. A method for matching an unknown image of an individual with a known image of another individual, the method comprising:

10

receiving an unknown facial image of an individual from a sender over the Internet at an image classification server; analyzing the facial image at the image classification server to determine if the unknown facial image is acceptable; processing the unknown facial image to create a processed image; comparing the processed image to a plurality of database processed images; matching the processed image to a database processed image of the plurality of database processed images to create matched images, wherein the database processed image is a facial image of another individual; and determining a perception value of the matched images.

2. The method according to claim 1 wherein the processed image is processed as a primary feature vector and the plurality of database processed images is a plurality of database feature vectors, and wherein comparing the processed image to a plurality of database processed images comprises comparing the primary feature vector to each of the plurality of database feature vectors.

3. The method according to claim 2 wherein matching the processed image to a database processed image of the plurality of database processed images to create matched images comprises selecting a database feature vector with a value that is most similar to the value of the primary feature vector.

4. The method according to claim 1 further comprising transmitting the matched images and the perception value to the sender over the Internet.

5. The method according to claim 2 wherein comparing the processed image to a plurality of database processed images further comprises applying a statistical model based on human perception as determined by user's votes of previous third party matched images.

6. The method according to claim 1 wherein the plurality of database processed images comprises from 50,000 database processed images to 100,000 database processed images.

7. The method according to claim 1 wherein the method occurs within a time period of 60 seconds.

8. The method according to claim 1 further comprising filtering the database processed image to provide a preferred database processed image for the matched images.

9. The method according to claim 2 wherein the primary feature vector and each of the plurality of database feature vectors are based on a plurality of factors comprising facial expression, hair style, hair color, facial pose, eye color, texture of the face, color of the face and facial hair.

10. The method according to claim 4, wherein the unknown facial image is transmitted as an electronic mail attachment.

11. The method according to claim 1, wherein the unknown facial image is a JPEG image.

12. The method according to claim 1 wherein image classification server comprises an input module, a transmission engine, facial recognition software, an input feed, a feature vector database, a perception engine and an output module.

13. The method according to claim 4 wherein the matched images and perception value are transmitted to a sender's web page on a web site.

14. The method according to claim 1 wherein the perception value ranges from 0% to 100%.

15. The method according to claim 1 wherein analyzing the unknown facial image at the image classification server comprises determining if a plurality of facial image factors are acceptable, the plurality of facial image factors comprising the lack of a facial image, the lack of eyes, uneven lighting, the brightness of the facial image, pose angle of the facial image, relative size of the facial image and pixel strength of the facial image.

US 7,668,348 B2

11

16. The method according to claim 4 further comprising transmitting a biography summary of a celebrity of the matched image from the image classification server to the sender.

17. A method for matching an unknown image of an individual with a known image of another individual, the method comprising:

- receiving an unknown digital facial image of an individual over a wireless network at an image classification server;
- processing the digital facial image at the image classification server to create a primary feature vector for the digital facial image;
- comparing the primary feature vector to a plurality of database feature vectors, each of the plurality of database feature vectors corresponding to a database processed image; and
- selecting a database feature vector that best matches the primary feature vector to create matched images.

18. The method according to claim 17 further comprising transmitting the matched images and the perception value to a mobile communication device.

12

19. A system for matching an unknown facial image of an individual with an image of a celebrity, the system comprising:

- an image classification server for receiving a digital facial image of an individual from a computer, the image classification server comprising
 - means for analyzing the digital facial image,
 - means for processing the digital facial image to generate a processed image,
 - means for comparing the processed image to a plurality of database processed images,
 - means for matching the processed image to a database processed image of the plurality of database processed images to create matched images,
 - means for determining a perception value of the matched images, and
 - means for transmitting the matched images and the perception value to the computer over a network.

20. The system according to claim 19 wherein the image classification server further comprises means for applying a statistical model based on human perception as determined by user's votes of previous third party matched images.

* * * * *

JS 44 (Rev. 12/07)

CIVIL COVER SHEET

The JS 44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. (SEE INSTRUCTIONS ON THE REVERSE OF THE FORM.)

I. (a) PLAINTIFFS

FACEDOUBLE, INC., a California corporation

DEFENDANTS

THE COCA-COLA COMPANY, a Delaware corporation and
CRISPIN PORTER & BOGUSKY, LLC, a Delaware limited liability
corporation

(b) County of Residence of First Listed Plaintiff San Diego
(EXCEPT IN U.S. PLAINTIFF CASES)

County of Residence of First Listed Defendant Delaware
(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF THE
LAND INVOLVED.

Attorneys (If Known)

(c) Attorney's (Firm Name, Address, and Telephone Number)

GORDON & REES LLP
Gregg I. Anderson / Maha Sarah
101 West Broadway, Suite 2000
San Diego, CA 92101
(619) 696-6700

FILED
10 MAR -5 PM 1:34
10 CV 0485 IEG RBB

II. BASIS OF JURISDICTION (Place an "X" in One Box Only)

- ☐ 1 U.S. Government Plaintiff
☐ 2 U.S. Government Defendant
☒ 3 Federal Question (U.S. Government Not a Party)
☐ 4 Diversity (Indicate Citizenship of Parties in Item III)

III. CITIZENSHIP OF PRINCIPAL PARTIES (Place an "X" in One Box for Plaintiff and One Box for Defendant)

- | | | | | | |
|---|----------------------------|----------------------------|---|---------------------------------------|---------------------------------------|
| | PTF | DEF | | PTF | DEF |
| Citizen of This State | <input type="checkbox"/> 1 | <input type="checkbox"/> 1 | Incorporated or Principal Place of Business In This State | <input checked="" type="checkbox"/> 4 | <input type="checkbox"/> 4 |
| Citizen of Another State | <input type="checkbox"/> 2 | <input type="checkbox"/> 2 | Incorporated and Principal Place of Business In Another State | <input type="checkbox"/> 5 | <input checked="" type="checkbox"/> 5 |
| Citizen or Subject of a Foreign Country | <input type="checkbox"/> 3 | <input type="checkbox"/> 3 | Foreign Nation | <input type="checkbox"/> 6 | <input type="checkbox"/> 6 |

IV. NATURE OF SUIT (Place an "X" in One Box Only)

CONTRACT	TORTS	FORFEITURE/PENALTY	BANKRUPTCY	OTHER STATUTES
<input type="checkbox"/> 110 Insurance <input type="checkbox"/> 120 Marine <input type="checkbox"/> 130 Miller Act <input type="checkbox"/> 140 Negotiable Instrument <input type="checkbox"/> 150 Recovery of Overpayment & Enforcement of Judgment <input type="checkbox"/> 151 Medicare Act <input type="checkbox"/> 152 Recovery of Defaulted Student Loans (Excl. Veterans) <input type="checkbox"/> 153 Recovery of Overpayment of Veteran's Benefits <input type="checkbox"/> 160 Stockholders' Suits <input type="checkbox"/> 190 Other Contract <input type="checkbox"/> 195 Contract Product Liability <input type="checkbox"/> 196 Franchise	PERSONAL INJURY <input type="checkbox"/> 310 Airplane <input type="checkbox"/> 315 Airplane Product Liability <input type="checkbox"/> 320 Assault, Libel & Slander <input type="checkbox"/> 330 Federal Employers' Liability <input type="checkbox"/> 340 Marine <input type="checkbox"/> 345 Marine Product Liability <input type="checkbox"/> 350 Motor Vehicle <input type="checkbox"/> 355 Motor Vehicle Product Liability <input type="checkbox"/> 360 Other Personal Injury PERSONAL INJURY <input type="checkbox"/> 362 Personal Injury—Med. Malpractice <input type="checkbox"/> 365 Personal Injury—Product Liability <input type="checkbox"/> 368 Asbestos Personal Injury Product Liability PERSONAL PROPERTY <input type="checkbox"/> 370 Other Fraud <input type="checkbox"/> 371 Truth in Lending <input type="checkbox"/> 380 Other Personal Property Damage <input type="checkbox"/> 385 Property Damage Product Liability	<input type="checkbox"/> 610 Agriculture <input type="checkbox"/> 620 Other Food & Drug <input type="checkbox"/> 625 Drug Related Seizure of Property 21 USC 881 <input type="checkbox"/> 630 Liquor Laws <input type="checkbox"/> 640 R.R. & Truck <input type="checkbox"/> 650 Airline Regs. <input type="checkbox"/> 660 Occupational Safety/Health <input type="checkbox"/> 690 Other LABOR <input type="checkbox"/> 710 Fair Labor Standards Act <input type="checkbox"/> 720 Labor/Mgmt. Relations <input type="checkbox"/> 730 Labor/Mgmt. Reporting & Disclosure Act <input type="checkbox"/> 740 Railway Labor Act <input type="checkbox"/> 790 Other Labor Litigation <input type="checkbox"/> 791 Empl. Ret. Inc. Security Act IMMIGRATION <input type="checkbox"/> 462 Naturalization Application <input type="checkbox"/> 463 Habeas Corpus—Alien Detainee <input type="checkbox"/> 465 Other Immigration Actions	<input type="checkbox"/> 422 Appeal 28 USC 158 <input type="checkbox"/> 423 Withdrawal 28 USC 157 PROPERTY RIGHTS <input type="checkbox"/> 820 Copyrights <input checked="" type="checkbox"/> 830 Patent <input type="checkbox"/> 840 Trademark SOCIAL SECURITY <input type="checkbox"/> 861 HIA (1395ff) <input type="checkbox"/> 862 Black Lung (923) <input type="checkbox"/> 863 DIWC/DIWW (405(g)) <input type="checkbox"/> 864 SSID Title XVI <input type="checkbox"/> 865 RSI (405(g)) FEDERAL TAX SUITS <input type="checkbox"/> 870 Taxes (U.S. Plaintiff or Defendant) <input type="checkbox"/> 871 IRS—Third Party 26 USC 7609	<input type="checkbox"/> 400 State Reapportionment <input type="checkbox"/> 410 Antitrust <input type="checkbox"/> 430 Banks and Banking <input type="checkbox"/> 450 Commerce <input type="checkbox"/> 460 Deportation <input type="checkbox"/> 470 Racketeer Influenced and Corrupt Organizations <input type="checkbox"/> 480 Consumer Credit <input type="checkbox"/> 490 Cable/Sat TV <input type="checkbox"/> 810 Selective Service <input type="checkbox"/> 850 Securities/Commodities/Exchange <input type="checkbox"/> 875 Customer Challenge 12 USC 3410 <input type="checkbox"/> 890 Other Statutory Actions <input type="checkbox"/> 891 Agricultural Acts <input type="checkbox"/> 892 Economic Stabilization Act <input type="checkbox"/> 893 Environmental Matters <input type="checkbox"/> 894 Energy Allocation Act <input type="checkbox"/> 895 Freedom of Information Act <input type="checkbox"/> 900 Appeal of Fee Determination Under Equal Access to Justice <input type="checkbox"/> 950 Constitutionality of State Statutes

V. ORIGIN (Place an "X" in One Box Only)

- ☒ 1 Original Proceeding
☐ 2 Removed from State Court
☐ 3 Remanded from Appellate Court
☐ 4 Reinstated or Reopened
☐ 5 Transferred from another district (specify)
☐ 6 Multidistrict Litigation
☐ 7 Appeal to District Judge from Magistrate Judgment

VI. CAUSE OF ACTION

Cite the U.S. Civil Statute under which you are filing (Do not cite jurisdictional statutes unless diversity):

35 U.S.C. Sections 271, 284 and 285

Brief description of cause:

Patent Infringement

VII. REQUESTED IN COMPLAINT:

☐ CHECK IF THIS IS A CLASS ACTION UNDER F.R.C.P. 23
 DEMAND \$

CHECK YES only if demanded in complaint:
 JURY DEMAND: ☒ Yes ☐ No

VIII. RELATED CASE(S) IF ANY

(See instructions):

JUDGE

DOCKET NUMBER

DATE

March 5, 2010

SIGNATURE OF ATTORNEY OF RECORD

Gregg I. Anderson

FOR OFFICE USE ONLY

RECEIPT #

AMOUNT

\$350

APPLYING IFP

JUDGE

MAG. JUDGE

ORIGINAL

INSTRUCTIONS FOR ATTORNEYS COMPLETING CIVIL COVER SHEET FORM JS 44**Authority For Civil Cover Sheet**

The JS 44 civil cover sheet and the information contained herein neither replaces nor supplements the filings and service of pleading or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. Consequently, a civil cover sheet is submitted to the Clerk of Court for each civil complaint filed. The attorney filing a case should complete the form as follows:

I. (a) Plaintiffs-Defendants. Enter names (last, first, middle initial) of plaintiff and defendant. If the plaintiff or defendant is a government agency, use only the full name or standard abbreviations. If the plaintiff or defendant is an official within a government agency, identify first the agency and then the official, giving both name and title.

(b) County of Residence. For each civil case filed, except U.S. plaintiff cases, enter the name of the county where the first listed plaintiff resides at the time of filing. In U.S. plaintiff cases, enter the name of the county in which the first listed defendant resides at the time of filing. (NOTE: In land condemnation cases, the county of residence of the "defendant" is the location of the tract of land involved.)

(c) Attorneys. Enter the firm name, address, telephone number, and attorney of record. If there are several attorneys, list them on an attachment, noting in this section "(see attachment)".

II. Jurisdiction. The basis of jurisdiction is set forth under Rule 8(a), F.R.C.P., which requires that jurisdictions be shown in pleadings. Place an "X" in one of the boxes. If there is more than one basis of jurisdiction, precedence is given in the order shown below.

United States plaintiff. (1) Jurisdiction based on 28 U.S.C. 1345 and 1348. Suits by agencies and officers of the United States are included here.

United States defendant. (2) When the plaintiff is suing the United States, its officers or agencies, place an "X" in this box.

Federal question. (3) This refers to suits under 28 U.S.C. 1331, where jurisdiction arises under the Constitution of the United States, an amendment to the Constitution, an act of Congress or a treaty of the United States. In cases where the U.S. is a party, the U.S. plaintiff or defendant code takes precedence, and box 1 or 2 should be marked.

Diversity of citizenship. (4) This refers to suits under 28 U.S.C. 1332, where parties are citizens of different states. When Box 4 is checked, the citizenship of the different parties must be checked. (See Section III below; federal question actions take precedence over diversity cases.)

III. Residence (citizenship) of Principal Parties. This section of the JS 44 is to be completed if diversity of citizenship was indicated above. Mark this section for each principal party.

IV. Nature of Suit. Place an "X" in the appropriate box. If the nature of suit cannot be determined, be sure the cause of action, in Section VI below, is sufficient to enable the deputy clerk or the statistical clerks in the Administrative Office to determine the nature of suit. If the cause fits more than one nature of suit, select the most definitive.

V. Origin. Place an "X" in one of the seven boxes.

Original Proceedings. (1) Cases which originate in the United States district courts.

Removed from State Court. (2) Proceedings initiated in state courts may be removed to the district courts under Title 28 U.S.C., Section 1441. When the petition for removal is granted, check this box.

Remanded from Appellate Court. (3) Check this box for cases remanded to the district court for further action. Use the date of remand as the filing date.

Reinstated or Reopened. (4) Check this box for cases reinstated or reopened in the district court. Use the reopening date as the filing date.

Transferred from Another District. (5) For cases transferred under Title 28 U.S.C. Section 1404(a). Do not use this for within district transfers or multidistrict litigation transfers.

Multidistrict Litigation. (6) Check this box when a multidistrict case is transferred into the district under authority of Title 28 U.S.C. Section 1407. When this box is checked, do not check (5) above.

Appeal to District Judge from Magistrate Judgment. (7) Check this box for an appeal from a magistrate judge's decision.

VI. Cause of Action. Report the civil statute directly related to the cause of action and give a brief description of the cause. **Do not cite jurisdictional statutes unless diversity.** Example: U.S. Civil Statute: 47 USC 553
Brief Description: Unauthorized reception of cable service

VII. Requested in Complaint. Class Action. Place an "X" in this box if you are filing a class action under Rule 23, F.R.Cv.P.

Demand. In this space enter the dollar amount (in thousands of dollars) being demanded or indicate other demand such as a preliminary injunction.

Jury Demand. Check the appropriate box to indicate whether or not a jury is being demanded.

VIII. Related Cases. This section of the JS 44 is used to reference related pending cases if any. If there are related pending cases, insert the docket numbers and the corresponding judge names for such cases.

Date and Attorney Signature. Date and sign the civil cover sheet.

Court Name: USDC California Southern
Division: 3
Receipt Number: CAS010851
Cashier ID: mbain
Transaction Date: 03/05/2010
Payer Name: SAN DIEGO LEGAL SUPPORT SVCS

CIVIL FILING FEE
For: FACEDOUBLE V COCA COLA
Case/Party: D-CAS-3-10-CV-000485-001
Amount: \$350.00

CHECK
Check/Money Order Num: 87311
Amt Tendered: \$350.00

Total Due: \$350.00
Total Tendered: \$350.00
Change Amt: \$0.00

There will be a fee of \$45.00
charged for any returned check.